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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item: D.1

India

INDUSTRIAL DEVELOPMENT

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Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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INDUSTRIAL DEVELOPMENT

by
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India, New Delhi

I The need for industrial development in the less developed areas

1. There are several countries which, while highly developed, import much of their raw material and a good deal of their food. There are other areas which have large physical resources which are yet untapped. There is, besides, in some of the latter countries, a very large population. In these conditions, the population is generally backward and poor, often living at or below the subsistence level. There is thus a considerable imbalance in the development of the world. This state of affairs was not questioned so long as, according to the spirit of the age, a colonial structure of the world was accepted. In the conditions of the modern world, however, with the rapid development of communications, travel and interchange of ideas, colonial structures are no longer accepted. Where they exist, tensions and frictions develop. In order to cure this situation, the large imbalance in world development has to be corrected and corrected speedily.

2. There are countries with very large resources and with relatively meagre populations. There are others where resources and population are more evenly balanced. There are still others where populations bear very heavily indeed on available resources. In any of these cases, development would mean development not only of physical resources but also of human material. It is only by a co-ordinated development of both that the world would reap the benefit of development. In areas with large populations, dependence on agriculture and on similar occupations for a living is considerable. The productivity of agriculture is usually low. There is unemployment to a degree and fairly widespread under-employment. Purchasing power is diffused and standards of living and consumption are usually low. In order to remedy these deficiencies, it is necessary to draw away surplus labour from agriculture and provide it with alternative occupations. This process, where populations are large, takes several years. Meanwhile, because of the usual

high rate of multiplication, the pressure on resources continues unabated. Only relatively small net relief is obtained. The need in the case of these countries is quite obviously for a very rapid rate of economic growth along with very effective steps for a reduction in the growth of population.

3. In the more fortunate countries which are somewhat better balanced between resources and population, again, standards of living and consumption are generally not very high. In these cases, industrial development would lead to higher overall purchasing power and higher standards of living and consumption. In the case of countries with large resources but relatively small populations, again, industrial development is needed for making available to the world as a whole, the resources which would be put to use by such development. The problem in regard to this last type of country, however, is often not such a crucial problem in regard to its own population. Sometimes, in such cases, the population remains low as a result of national policies e.g., restriced immigration and such measures.

4. There are thus three types of situations. The problems of development in these cases and remedies for them are not all similar. Nevertheless, it is true that in all cases industrialisation generates new resources in the form of newly exploited physical resources, higher income and purchasing power which would help in developing the country all round, and human resources in the form of new skills. All these factors would contribute to an overall increase in welfare. The element of the development of human resources is, in many ways, even more important than the development of the other kinds of resources. Up till recently, there have been, on the one hand, the industrialised areas where the level of educational, technological and intellectual development has been high. On the other hand, there have been vast pockets of illiteracy and poor educational development where there has been little preparation for the use of technology. There have been, so to speak, the elite and the non-elite. This position can no longer remain without active steps being taken to amend it. In the age of science and technology, the existence of two classes of humanity cannot but breed differences, misunderstanding and trouble.

5. Industry set up by the use of technology is not merely a means of achieving economic betterment. It is a way of life. It has been the experience of countries and areas which have become relatively recently industrialised that life takes on a new tempo and a new meaning. People get to be in a hurry and want to get things done. In many areas of the world, it is this urge in relation to the use of time and to get things done that is needed. When a realisation of the value of time and of science and technology gets to be more widespread, there would be a closer sharing in progress world-wide: and, the less-developed countries will receive this benefit in the direction of a very much quickened intellectual and other development. Needless to say, this movement can bring nothing but benefit to both the developing countries and to the world as a whole.

II Formulation of industrial programmes in the less developed areas

6. It is becoming increasingly recognised even in the developed countries that the optimum use of resources is secured only by some kind of programming. France and the United Kingdom which are normally looked upon as countries with a markedly free enterprise outlook, can be mentioned in this context. In the case of the less developed countries the need for programmes is even greater, considering the size of the problem of physical development and of the preparation of the population for achieving development by the use of science and technology. The formulation of programmes is necessarily dependent on the nature and volume of physical resources, the levels of income and consequent capacity for saving, and the stage of development in education, particularly technical education, in these countries. The programmes must ensure an immediate rate and pattern of development needed for them to achieve self-sustaining growth after an initial period of sizeable dependence on external assistance. It is only by careful programming that it will be possible to relate the desired rate of growth to the internal resources and external assistance available.

7. The conscious promotion of industrial development necessitates a national economic plan which will give direction and a sense of purpose to the people. The vicious circle of "underdevelopment" may be broken at a number of points. But the will to do so must first be there or be generated. There must be an awakening and a driving desire for change. Without these, no measures for improvement are likely to be successful. Both the political and the social measures necessary for promoting these urges must be undertaken. But development in the economic field need not await the completion or near-completion of such reforms. Indeed, economic development often provides these urges itself. An industrial society has a built-in motivation for growth and progress. While the plan will reflect the hopes and aspirations of a people, it must be practical, effective and realisable.

8. Plans are usually conceived in terms of investment. Decisions have to be taken to increase the amount of investment with a view to adding to the productive power of the country and hence to the growth of income per head. In a country depending largely on a primitive or near-primitive agriculture, there are not the surpluses which provide the resources for investment. Nevertheless, until industry becomes established and can provide surpluses, agriculture has to make a substantial contribution towards investment. The promotion of industrial development and the rapid improvement of agricultural production and productivity are, therefore, interdependent. A programme of developing manufacturing industries in an underdeveloped country is, thus, called upon to assist in improving agricultural production through the use of fertilizers and agricultural implements, in providing alternative employment to those who are, or would become, surplus in rural areas and in creating new employment opportunities for the existing unemployed and the expected additions to the labour force. All this entails a concentrated effort in the field of exploitation of new resources.

The building of dams for irrigation and the generation of power, the manufacture of fertilizers, the mining of coal, iron and other minerals, the development of railways, roads and other means of communication and the setting up of workshops and factories, are all means through which the nation's resources are utilized. The provision and the expansion of facilities for training people who participate in the starting and running of these projects add to the quality and quantity of skilled human resources. By this process, productivity increases, incomes and expectations rise, a managerial and entrepreneur class grows, one scheme leads to another and industrialisation becomes a cumulative, self-generating and self-propelling process necessitating and leading to the fullest use of existing resources and the development of newer ones.

9. The plan for economic development has to be an integrated plan in which the place of industry has to be consistent with and in phase with growth in other sectors. It would be futile, for instance, to plan industrial development on a long-term basis without agricultural development which will provide the initial investment surpluses, or without development in the fields of education - especially technical and technological education - and health. While the most complicated industrial installations take no more than five to six years to set up, it takes a minimum of fifteen years to produce one good engineer: and, having produced an engineer, the nation obviously requires that his skill and talents are used for the longest possible period through healthy longevity. Other aspects of the infra-structure like railways, roads, coastal shipping services and utilities like power are also basic to industrial development and have to be planned alongside - and in many cases ahead of - industrial development. The industrial programme itself has to be planned in terms of targets, both physical and financial. Production of individual items has to be in conformity with anticipated demand, both internal and in the export market. This applies especially to cases where the output of one industry is an input of others. The relationship between steel and engineering industries is a case in point. India's plan to put up three new steel plants simultaneously during the Third Five-Year Plan was considered at the time too bold. We now find that this was not really enough. There is, again, a considerable inter-dependence between steel and cement for constructional purposes. The shortage of either interferes with the implementation of programmes of industrial building and housing.

10. The preparation of a national plan requires a careful study of available resources including imports. On the side of demand, one must not forget the demand in foreign markets, current or potential. The planning of investment in the Indian textile industry consistently takes into account the measures necessary for increasing production of cloth both to meet internal demand and to cater for the export market. In the planning of the engineering and chemical industries, again, we do take into account our export potential.

11. The balancing of supply and demand has to be visualised in physical terms. But as the operation of the economy is carried

on through a monetary system, it becomes necessary to mobilise the financial resources which will make possible the investment required to be made. Most of these resources will generally be in local currency and involve an increase in the rate of saving. India's Third Five-Year Plan, for instance, envisages a rise in the rate of domestic saving from 8.5 per cent to 11.5 per cent. Progressive increases in taxation, loans from the public, small savings, profits from commercial enterprises in the public sector and some degree of deficit financing are the sources which would provide the needed investment funds. Basically, all these represent a postponement of consumption. In the case of economies which need rapid development and which are usually low-income and low-consumption economies, the burden of consumption postponement poses a serious dilemma which is not only economic but also has political and social aspects.

12. It is here that the richer and more developed countries have a stake, an opportunity, and, one may even perhaps venture to say, a duty. The underdeveloped countries of the world have much the larger proportion of the world's population. There is a very considerable gap between their standards of living and those of the richer industrial nations. The numbers multiplied by the gap is a measure of the opportunity in terms of consumption potential and, therefore, of the growth potential available both to the developed and to the underdeveloped countries. There is a growing understanding of the process of development in the world, thanks to intensive work by international bodies, Governments and institutions. Loans by the Governments of the more prosperous industrialised countries and by specialised institutions are on the increase. There is a growing international flow also of private capital.

13. The financing of development in these forms has begun already to pose other problems. The loans now being received have to be serviced and, later, repaid. This can be done only through an ever-increasing flow of exports from the developing countries. High tariffs, quantitative restrictions and regional economic groupings generate a certain amount of pessimism in regard to their development in the minds of the people of the less-developed countries. It is their hope that exactly as the problem of providing finance for development is being better understood and implemented, so will the growing problem of the servicing and repayment of loan assistance be understood and resolved. One-fifth of the aid which India expects to receive during her Third Five-Year Plan is meant to cover the refinancing of her maturing obligations. Commitments of this order entail a severe and continuing strain on the balance of payments of the developing countries. This pressure is aggravated by the deteriorating terms of trade and the unwillingness of the industrialised countries to accept imports of manufactured goods from their erstwhile markets. The programme of investment of the developing countries will itself, in some measure, have to be reoriented towards fostering certain industries more for their export potential than for meeting internal demand. In this, of course, economic considerations of a rational international division of labour and the possibility of the channelling of expansion of existing industries or the starting of new industries by the

less-developed countries into directions where such countries will be economically efficient producers, should receive due attention. In order that the less-developed countries may not lag far behind the industrialised countries technologically, consideration has to be given to the acquisition of skills in fields such as the peaceful uses of atomic energy - e.g., atomic energy power generation - and electronics. Planning should include training programmes both at home and abroad in such fields so that, at an appropriate stage in development, local nationals will be available to deal with at least the maintenance and repair of modern plant utilising such techniques and technology.

III Implementation of an industrial development programme

14. A programme of industrial development having been decided upon in terms of the exploitation of natural and human resources, the extent of development in different industrial fields, inter-industrial relations and financial resources, the all important question of implementation arises. Planning and implementation are complementary. Planning has to take account of the available physical resources and, even more importantly, of human resources in terms of skills. The practicable pace of development of services like transport and communications and power generation, besides the pace at which skills can be imparted by training, quite often sets the targets and the pattern of a plan. In the absence of a sizeable managerial and entrepreneurial class, the functions of planning have largely to be undertaken perforce by Governments. Governmental responsibility in this matter is attracted also by the need from the beginning to aim at the securing of a wide measure of social justice, on human grounds as also in the interests of the preservation of democratic values and ways of life. In discharging this responsibility for planning in a democratic system, the Governments would naturally have to associate with themselves the existing managerial and entrepreneurial classes as they associate other classes. They would have to ensure that both in drawing up the plan and in the implementation of it, there is a fair measure of general agreement upon the aims and objectives as also the practical pattern of implementation.

15. In the circumstances of the industrial development of the less-developed countries, a certain direction and deployment of scarce resources is inherent. Market forces alone will not be a sufficient instrument for the securing of the overall national interest. A degree of control becomes inevitable and would have to take the form of licensing of industrial activity which has, for a corollary, supplementary measures such as the control of capital issues, restricting and channelling of the use of foreign exchange, a distribution control on important industrial raw materials and services which are in short supply etc. There is also the positive aspect of this situation. For instance, the Industries (Development & Regulation) Act, 1951 (of India) which enables Governmental interference with the exercise of entrepreneurial choice, provides simultaneously for liaison and co-ordination between Government and industry through a number of Development Councils for different

industries or groups of industries which do a continuous review of the quantum and pattern of growth in their respective fields.

16. The developing countries often have a sizeable industrial sector based on traditional skills and techniques generally producing consumer goods and handicrafts. These, and especially the latter, have been at different times, considerable earners of foreign exchange besides supplying internal demands. Capital resources even in terms of local currency are not limitless. It is, therefore, necessary, in those fields in which small scale production based on traditional skills and techniques are not altogether ruled out, not only to maintain but also enlarge production by these labour-intensive techniques. While available capital resources are being deployed towards the establishment of a satisfactory infra-structure of services, skills, utilities and basic industries, the rising needs of a growing population with aspirations of at least slightly higher consumption levels could be met in this way. By slightly mechanising and otherwise improving techniques and designs, the products of these industries and crafts could provide extra export earnings in volume which is not to be scoffed at. The case of the Indian handloom textile industry is an important instance of a craft industry which has made and is making a very valuable contribution to the economy. There are some other industries which may be mentioned in this connexion, e.g., the tanning and shoe-making industries, the edible oil extraction industry, the hand-made paper industry etc. In all these fields, there are, in India, units both in the small scale industry sector and in the organised factory industry sector. A division of labour between these sectors has been successfully attempted. For instance, the handloom industry uses mill-spun yarn and makes certain varieties of cloth which lend themselves more to decentralised production. By the application of mechanical attachments or of power to these looms, the textile industry can be, and has been, to a large extent, decentralised. These developments are similar to the existing pattern of the cotton textile industry in Japan. The vegetable tanning industry is carried on on a small scale with improvements, and caters for the foot-wear and agricultural needs of the rural population. With improved techniques, the small scale shoe-making industry not only supplies the internal market but exports substantialquantities of foot-wear to several countries. The vegetable oil industry is decentralised through improved techniques, in regard to edible oils. Oilseeds are crushed in rural communities who consume the oil and utilize the cake as manure and fodder. The mill sector produces industrial oils, e.g., linseed, castor and groundnut (which is used as the base for the hydrogenated oil industry). The pattern here is that where strict laboratory and chemical control is needed, the operations are done generally in the mill sector whereas for providing just a wholesome article of diet, the rural sector is not only sufficient but makes a valuable contribution through saving two-way transport thereby improving the economics of oilseed and oil production and contributes valuable manure to the rural economy. The hand-made paper industry provides employment in communities where there is often not any other industrial activity. Sometimes, the hand-made paper industry uses mill-made dry pulp. These are all craft industries which have been and are being improved

constantly by technical assistance and financial support in the form of credit provided by Governmental agencies. At least at a transitional stage for providing consumer goods, this evolution and improvement of craft industries would make a contribution of considerable value to economic development while limiting the pressure on available capital resources. Several of these industries could be developed into modern, mechanised industries at a later stage, thereby releasing the operatives from a concentrated and wearying effort over long hours to earn their daily bread and giving them a little leisure and opportunity for developing their personalities in human and cultural terms. The skills learnt in the transitional stage would be valuable in the later stage. An endeavour is made continuously to increase productivity in these craft and semi-mechanised craft industries so that earnings and conditions of work may improve as also the quality and quantity of production. The reservation of particular varieties and sectors to these craft-improved industries in sectors of industry where there is also an organised factory industry has needed much thought and organisation and is known in India as the provision of "common programmes" for small scale and larger scale industries.

17. Even at a later stage in industrial development when the developing countries have become modern industrial economies, decentralisation based on the use of power will provide sizeable social gains. The arrest of the drift to the town and city would solve or prevent altogether from developing, the problems associated with the typical industrial city of the West, e.g., housing, travel and other problems identified with concentration. Even in large industries, Japan has preserved a very considerable decentralised pattern. In the Western world, there is a reappraisal of the pattern of industrial development constantly going on. The "new towns" of Britain, satellite towns and the growing rural industrial communities in the U.S.A. are all significant pointers. The developing countries would do well to urbanise the rural areas by the provision of amenities like electricity and power, housing, health and sanitation facilities, roads and communications, bus and coach services and amusement facilities before the drift to the town sets in. Indian experience in the provision of rural industrial estates is encouraging. This deliberate and conscious action would also ensure a dispersal of industry and, through it, of employment and prosperity throughout the country.

18. A most important need, more even in the field of implementation than of planning, is the provision and utilisation of technical and technological training through basic training, in-plant training, theoretical training through evening classes, sandwich systems and other such means. As securing the effective availability of a large number of engineers for the ultimate goal of a modern industrial economy based on the full use of science and modern technology is a long-term process, the teaching of mathematics and science and the creation of facilities for higher education in engineering and technology are problems of the highest priority and urgency although the fruits of this investment cannot be gathered quickly. This cannot and must not be neglected. This applies also to the conscious direction of training in management

and cost accounting. The availability of design engineers has to be dovetailed with the opportunities for their effective employment. There should be a planning of the training of design engineers taken in hand simultaneously with the planning of the heavier engineering and chemical industries so that there is no gap in the need for and the availability of design engineers.

19. Developing countries which have to plan in terms of self-sustaining growth have to go in for some basic industries like steel and the machine building industries. The volume of production and the programme for the establishment of these industries will differ from case to case. They will depend on factors like the availability of raw material, e.g., iron ore and coal, the availability of transport, communications and power and the availability, current and potential, of technically trained personnel. These industries generally call for heavy investment and pose organisational and managerial problems of a nature which private enterprise often finds it difficult to tackle. They also involve a considerable waiting period before profits come in and, even then, do not always bring in high profits. For these reasons, the private sector, in which the main motivation is profit, is unable and unwilling to tackle the establishment of such industries. A certain amount of activity in the public sector in these major fields is thus, often, inevitable. World thinking is now moving in the direction that there should be a maximisation of profit in the public sector industries including public utilities so that surpluses may be generated which can be invested in further economic and social development. This would ensure the attainment of the objectives of development which add up mainly to securing the largest social gain for a particular volume of investment. The public sector, being a new entrant, can, in many fields, also provide wholesome competition to the private sector especially where there is a certain reluctance in the private sector to modernise plant and techniques. There would, therefore, be need, in implementing plans of industrial development, to demarcate areas, in the national interest, which should be reserved altogether for the public sector, areas in which both the public and private sectors may operate together in free competition and those which may well be left to the private sector ordinarily. The forms of organisation of the public sector and the conduct of the relations between Parliament, Government and the management in the public sector all need careful consideration. The need for plant autonomy and the requirements of securing the most prudent use of public funds have to be reconciled in a pragmatic and practical manner. The location of industries has to be planned in such a way as to achieve a workable compromise between pure economic factors pertaining to particular units or industries and the need for dispersing not only employment, purchasing power and prosperity but also opportunities for the exercise of technical, technological and managerial skills throughout the country. In the small scale sector, co-operative organisation has given impressive results in the fields both of production and of marketing. In a monetary economy, it is obvious that the needs of industry both in the organised factory sector and in the small scale sector have to be recognised and catered for by specialised financing institutions like Industrial Finance Corporations, Industrial Credit and

Investment Corporations etc. The normal banking system would, in most cases, provide the working capital and short-term finance. Resources have to be found for at least partly financing the public sector by appropriate Governmental revenue and fiscal policies both in the form of equity participation and in the form of medium and long-term loans. And, overall, both for the private and for the public sectors, external resources have to be found both by following a dynamic export policy and by securing long-term loans on favourable terms in regard to repayment in local currencies, where possible, and low interest rates. Continuing and ever-more sophisticated technical assistance has also to be secured from abroad over a period of years.

20. The economic development of the less-developed countries, therefore, sets a challenging task both to the developing countries and to the more advanced and prosperous industrialised countries. The peaceful application of science and technology to the solution of the massive problem of securing the rapid economic development and rising prosperity of the less developed millions of the world is a task worthy of the highest goals of achievement both of the mind and the spirit in the "decade of development" and generally in the second half of the twentieth century.

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INDUSTRIAL DEVELOPMENT

by

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I The need for industrial development in the less-developed areas

Less-developed countries are of three kinds - those with large resources having small populations; those whose resources and populations are more evenly balanced and those which are very heavily populated in relation to resources. In all these cases, economic development involves the development both of resources and of human material. In less-developed areas with large populations, dependence on agriculture is considerable and standards of living and consumption are low. Labour has to be drawn away from agriculture and provided with alternative employment.

2. The development of human resources through educational, technical and technological development is even more important than the development of physical resources. Modern industry is a way of life and leads to quickened intellectual and material development.

II Formulation of industrial programmes in the less-developed areas

3. The formulation of programmes of development is essential for the less-developed countries. Physical resources, incomes and capacity for saving and the stage of educational development are determinants for the formulation of programmes. Self-sustaining growth has to be aimed at. There has to be political, social and cultural development also. But industrial development need not await the completion of the processes of such development.

4. In predominently agricultural countries, agricultural development is important: initially agriculture has to provide the surpluses needed for investment in industry. So agricultural development, development of natural resources and railways and other services and utilities have to be planned together as also the training of technicians and technologists.

5. The plans for economic development have to be integrated plans. The place of industry in overall development and inter-industrial relations have to be determined. Supply, both for the internal market and for export, has to be balanced with the demand.

6. As modern economies are money economies, financial resources for investment have to be mobilised. Rates of domestic saving have to be raised. In what are low-income economies, consumption postponement poses a dilemma. The industrialised nations have an opportunity and an increasingly better understood and accepted responsibility. They have to provide trade opportunities in finished goods to the developing countries. The latter may have to foster export-oriented industries.

7. Technological education and training have to take in the newer techniques and technologies, e.g., atomic energy and electronics.

III Implementation of an industrial development programme

8. Planning and implementation are complementary. The pattern and targets of a plan are determined by practicable pace of development of utilities, services and physical and human resources.

9. In less-developed countries, both in planning and in implementation, Governments bear a responsibility. Governmental action has a positive role besides functions of control, e.g., continuous consultation and co-operation with industry.

10. Labour-intensive techniques have to be utilised at least as a transitional measure for producing goods both for domestic consumption and for export. Techniques have to be constantly improved for increasing productivity. Delimitation and demarcation of lines of production between small-scale and large-scale industry are sometimes needed.

11. Decentralisation leads to social gains, e.g., avoidance of the drift to the town and the securing of a dispersal of industry, of employment and prosperity.

12. Technical, technological, managerial and cost accounts training have to be taken up very early during the process of planning. Design engineers need to be created. The public and the private sector have to be dovetailed. Forms of organisation of the public sector and parliamentary and governmental relations with the public company or corporation have to be worked out. Location of industry has to be carefully planned and finance secured through specialised institutions. Co-operative organisation has to be promoted in the small-scale sector particularly. External resources have to be found by instituting a dynamic export policy and by obtaining long-term loans. Technical assistance from abroad has also to be secured.

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Agenda Item: D.1

Syrian Arab République

INDUSTRIAL DEVELOPMENT IN SYRIA

By Dr. Y. SIOUFI,
Assistant General Secretary,
Ministry of Industry

Eng. M. SAHTOUT,
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Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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INDUSTRIAL DEVELOPMENT IN SYRIA

By : Dr. Y . SIOUFI Assistant General Secretary
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Engr M. SAHTOUT Director of Organising Dept.
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The role of industry in the underdeveloped countries is considered as a major factor in attenuating the consequence of economical fluctuations and in acheiving a continuous and sound growth of national income.

The Syrian Arab Republic suffered and still suffers from economic crises due to the instability of its national volume income , which still and to a large extent , is dependable on the natural conditions . If the yield of crops is good , then the national income of the countyr is high , and the great majority of the people will find themselves with more income to spend , which will increase the volume of demand of all types of goods , and that will create a better opportunities for small local enterprises to grow and finally the national economy will be prosperous and an actual development will be acheived.

The development of industry on a scientific basis connot be done in a spontaneous way , otherwise a development thus arrived at , would be but provisional unable to modify either the structure of the national economy or to give this structure any immunity against internal and external economical fluctuations, therefore it is very helpful to study the most important factors which affect the industrial development ,that have direct influence and important role on the development of the national economy.

The main factors that form the axis of our study are :
Labour , Labour skills , Capital , Management , Marketing .

Labour :

Although the number of workers needed is sufficient , their technical skill is still below average , therefore, we think it is not preferable to have automized industries , because automized machines need prompt and high level of maintenance and skilled technicions to run them , besides such industries will not help much in solving the problem of unemployment wich is considered as an a essential problem in the(under - developed) ccuntries.

Some under - developed countries have already aimed at a complte automized industrial development , but they failed in attaining their goals , and their economy fell , because a great part of their riches was uninvested and frozen

If we considor the ordinary industrialization that suits the social structure of(under developed) countries find that they need skilled labour at the first stage of a planned industrial development because most of the workers belcng to the agricultural sector , and are alien to the requirments of industry . They are in need of a training that would qualify them to work in this sector The Arab Syrian Republic has treated the matter by estblishing

vocational training centers , and .. this projects is now being executed . It involves the establishment of two centers , one in Damascus and the other in Aleppo · · · Each is composed of five sections for the different crafts and industries needed by the country. It is expected that one thousand workers nearly would be graduated yearly .

Labour Skills :

The skilled worker forms an important element necessary to ensure a progressive production and to improve it . Although the Syrian worker is a def and strict one , nevertheless he has to be trained and to get the qualification necessary for the high level demanded by the industries which have begum to be established in the country since the middle of this twentieth century , The scope of this will hot be confined only to train the worker to · run machines , that is easy to obtain , but the real skill the worker is in need of is what would ensure a productive harmony among the workers of one group , then among workers that belong to the groups of a section , then among the sections of one project , then among workers that belong to complementary projects , then among the workers of the whole industrial sector , and at last harmony among the workers af all sectors of the country

Capital :

It is one of the most important factors for development , and needs some political , social , and economical conditions to play its full constructive part. Stability , the performance of a project within the appointed time , social , justice , economical relations technical capacity and finaly industrial legislation , could make the capital confident and ready to be invested without hesitation or fear.

On the other hand , organizing the financial market , beside what we already said , will 'facilitate the gathering of the sparings of the individuals and make it easier to be invested in projects which stimulate rapid economic development .

Management :

Industrial management is a technique lacking in the industrially under - developed countries . It is the main axle and the efficient element necessary for the successful acheivement of industrial development . For each project requires a special scheme capable of ensuring a harmony among the principal elements of production, sot that the work may go on in the best conditions possible espacially most of the projects contain different groups of workers that necessitate the existence of a kind of mutual understanding and cooperation in order to form an intergral mass where consent and harmony prevail . It is possible to make up for this deficiency by the establishment of an institute for high management where lessons and lectures will be delivered on the technique of management and on the organization of projects , and where may be analyzed the up - to -date scientific theories about the technique of management and the necessary conditions demanded by the economical and social structure of the country .

Marketing :

Marketing has principles and methods that envolve according to the international economical relations and to · the kind of understanding prevailing in those relations . The skill in this field consists of ensuring constant external and internal markets to

prevent the accumulation of abnormal stock in production , on the one side , and to ensure the sale of the growing production on the other side .

The weakness of the economically underdeveloped country is seen here in this field with its fullest maning . The economical and social history of each country subordinated to a single country or to an economy dominating it , shows the effect of this position upon its activity at the begining of its free life , for it has but one traditional market to the conditions of which it must be subject and also to the fluctuations of those conditions.

We think that the fulfillment of an organized grouwth in the Syrian Arab Republic will not take place unless the republic modifies the basies of its marketing which will become an efficient factor in ensuring an increase in its national income and not a means to dominate it .

The agricultural income is not stable as to its kind and volume and follows the natural fluctuations . Therefore it is necessary to find external markets which will play the role of regulation as to increase and decrease , and as to the balance of industrial products. Now , we can summarize the stimulating means of marketing and the sale of products as follow:

a. Development of internal market by a constant effort to increase the parchasing power of different groups of people , especially that of the peasants who form in the under-developed countries a ratio that may go sometimes as far as 80 % of the total of the population , this to be arrived at by improving the means of the agricultural production in ordre to increase the yield of crops that will in turn increase the income of the peasant who , consequently , will become able to buy his needs of industrial products.

And so the internal consumption will become more active and will absorb big quantity of growing industrial production and discharge some of the general stock when happening .

b. Establishment of an Arab common market that will begin by loosening the commercial restrictions between the participant Arab countries and by decreasing gradually the custom tariffs and organising the industrial policy between them , and will finally arrive at creating a complete economical union , one that is similar to the European common market.

The Regional Centralization of Industries:

The Syrian Arab Republic is now suffering a regional centralisation in its industry , because its greatest and most important industries are placed in Damascus and Aleppo , Homs has already begun competing with those two cities , exploiting its geographical situation in the middle of the country , after having established the petrol refinery and a nitrogen fertilizers plant in addition to some other great plants to be established.

The causes of this centralization are attributed to the availability of capital employee , technicians , communications, public services and other facilities more than the other cities and districts in Syria.

To suppress this centralization and to revive all the districts without differentiating between a far away district and a nearby one, the scheme of development should be based upon the establishment of industries and special projects in every district according to its situation and possibilities , and necessary laws should be issued in order to allow tempting exemptions for long periods to the owners of projects in the far district:

For ex. (exemption from income tax for five years to every one who will execute a project in one of the districts of DARA , SOUAIDA , Hamma and for eight years to those who excute a project in one of the districts of El Rachid , Dair Elzor , Al Hassaka , ...)

Raw meterials necessary to industrial buildings must be exempted from customs tax in an effective way and raw materials necessary to the production must also be exempted from customs tax or at least the tax must be roduced as law as possible , especially when local industrial products are to be exported.

We add to the above the necessity of improving the roads of communication and of ensuring the public services in all the districts in which it is planned to establish certain industries.

Special operational problems :

These problems could be summerized as follow :

a. Lack of technical studies on the types and kinds of machines and equipment to ensure the selection of the best kinds needed both , from the technical and economical point of view.

b. Poor maintenance of machines and equipment which gives way to up normal defects and premature exploitation .

To overcome those diffculties , we think it is necessary to run training courses by the firms that produce the machines in order to train workers on how to use , maintain and repair them ; and in order to know their technical characteristics and their capacities . Or otherwise these firms may send a specialist of their own to supervise the working andmaintenance and installing , and operating such machines.

Climatic conditions :

The climate in the Syrian Arab Republic does not represent a fun demental problem for its industries , and it was possible to overcome certain secondary problems concerining some industries that require a special and relative degree of humidity , by the use of air - conditioning and other technical and modern means.

Specifications and standards:

There are now aday. some essential difficulties that impede the fixing of technical specifications for all the industrial products. first comes the inexistence of an industrial laboratory , second comes the great number of various products and the variety of tastes, all of them necessitating technical and scientific studies requireds for

the fixing of technical specifications and the elaboration of a standardization for the different industrial products , in order to be in touch with the international process of production . The Ministry of Industry proceeds now an agreement with the cocerned departments of the United Nations and collaborating with them, to the establishment of a modern industrial laboratory necessary for the purpose.

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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.1

Syrian Arab Republic

INDUSTRIAL DEVELOPMENT IN SYRIA

By Dr. Y. SIOUFI,
Assistant General Secretary,
Ministry of Industry

Eng. M. SAHTOUT,
Director of Organizing Dept.,
Ministry of Industry

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

NOTES

1. Papers selected for inclusion in General Sessions will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

2. Papers selected for inclusion in Specialized Sessions will be available at the Conference in only one of the above official languages.

3. Summaries of all papers, as submitted by contributors, will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

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INDUSTRIAL DEVELOPMENT IN SYRIA

By: Dr. Y. STOUFI Assistant General Secretary,
Ministry of Industry.

Eng: M. SAHTOUT Director of Organizing Dept.,
Ministry of Industry.

SUMMARY.

Industry is considered in the countries in course of development the the essentialelemont for the continuous and harmonized growth of the national income .

1. The principal factors of the industrial development .

   a. Skilled manpower :

      Workers are in need of a vocational training to raise their productivity and to give them a high industrial standard

   b. The Capital :

      Some political , social and economical conditions are required for the capital to play its constructive rôle .

   c. Management :

      Good management is now an indispensable condition for the success of industrial plans . The problems raised by human , economical and commercial relations require a mamagement capable of ensuring a harmony, between all the factors of production.

   d. Commercialization :

      It consists of ensuring a continuous expansion both of local market and foreign one in order to prevent the accumulation of stocks coming from the increase in production .

2. Problems of industrial development .

   a. The geaographical distribution of Industries:

      This may be ensured by the use of an adequate legislation that will encourage the investment of capitals in the poor and far - off regions .

   b. The rational exploitation :

      It demands the preparation of technical and economical studies necessary for increasing the potential of production of each plan , the choice of equipments and their mantenance

c. The technical specifications and standardisation:

The ministry of industry, in callaboration with the organisation of the united nations , studies the possibility of extablishing a special committee that will work for the industrial products a standardization and recognized and approved technical specifications

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Point de l'ordre du jour : D.14

France

LES MACHINES POUR LA FABRICATION DES MATERIAUX DE CONSTRUCTION : LEUR ADAPTATION AUX BESOINS DES PAYS EN COURS DE DEVELOPPEMENT

Par E. C. BLANC,
Ingénieur, Président du Groupe
"Préparation Mécanique" au Syndicat National
des Matériels d'Equipement M. T. P. S.

Les mémoires rédigés à l'intention de la Conférence des Nations Unies sur l'application de la science et de la technique dans l'intérêt des régions peu développées sont des documents de travail. Ils sont publiés tels qu'ils ont été présentés et les assertions et opinions qu'ils contiennent sont celles de leurs auteurs.

NOTES

1. Les mémoires choisis pour être présentés en séance générale pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

2. Les mémoires choisis pour être présentés en séance spéciale pourront être obtenus à la Conférence dans l'une seulement de ces langues officielles.

3. Les résumés qui ont été rédigés pour tous les mémoires par les auteurs de ceux-ci pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

4. Préalablement à la Conférence, les mémoires et les résumés ne feront pas l'objet d'une distribution générale mais d'un tirage restreint destiné aux délégations des gouvernements et autres participants officiels. La publication et la distribution générale des actes de la Conférence s'effectueront conformément aux règles et pratiques agréées par le Comité des publications des Nations Unies.

LES MACHINES POUR LA FABRICATION DES MATERIAUX DE CONSTRUCTION : LEUR ADAPTATION AUX BESOINS DES PAYS EN COURS DE DEVELOPPEMENT

Par E.C. BLANC, Ingénieur, Président du Groupe "Préparation Mécanique" au Syndicat National des Matériels d'Equipement M.T.P.S.

1. Dans l'établissement de l'infra-structure d'un pays, la construction joue un très grand rôle, qu'il s'agisse de l'habitat, des édifices publics, de bâtiments industriels ou commerciaux, des voies de communication, ou des ouvrages d'art de toutes natures tels que ports, barrages, canaux d'irrigation, tunnels, viaducs, etc.

2. A la base de tous ces travaux de construction, il y a l'approvisionnement et la préparation des matériaux dont la caractéristique commune est d'être pondéreux, et par conséquent coûteux à transporter.

3. La condition première sera donc d'utiliser, dans toute la mesure du possible, des matériaux extraits et préparés sur place.

4. Quelle que soit la nature des ouvrages envisagés, il y aura deux grandes classes de matériaux à mettre en oeuvre : les agrégats et les liants.

5. Les agrégats pourront être, selon la nature géologique des terrains avoisinants :

   i - soit des roches extraites de carrières (pierres de taille moellons, pavés, pierres concassées, gravillons, sables de broyage

ii - soit des matériaux en provenance de dépôts alluvionnaires: galets, graviers et sables naturels

iii - soit, enfin, des terres argileuses susceptibles de durcir par séchage ou par cuisson (fabrication de briques, tuiles, poteries, etc.

6. Les liants, destinés à donner cohésion aux éléments précédents, sont :

i - soit des produits bitumeux ou hydro-carbonés utilisés pour l'établissement des routes et des pistes d'envol, ainsi que pour les revêtements d'étanchéité

ii - soit des liants hydrauliques (chaux, ciment, plâtre, matières pouzzolaniques).

7. Notre intention n'est pas de rappeler tous les prpcédés de fabrication connus, ni de décrire par le détail toutes les machines propres à l'obtention des divers genres de matériaux de construction.

8. Nous nous bornerons à mettre en relief ce qu'il peut y avoir de très particulier, pour ce qui concerne chaque branche d'industrie, dans le cas des pays de développement industriel récent, et dans quelle voie peuvent être recherchées des solutions à la fois techniquement évoluées et économiquement réal' ables.

A - Préparation des agrégats

9. Il y a deux grandes catégories d'agrégats : ceux provenant de l'exploitation de dépôts alluvionnaires et ceux provenant de l'exploitation de carrières.

10. Accessoirement, on peut avoir dans certains cas la possibilité d'utiliser des produits secondaires tels que des roches stériles rejetées par des travaux miniers, ou encore des scories de fours métallurgiques. Enfin, il est possible de faire figurer dans cette rubrique les fibres d'amiante (fabrication de produits en amiante ciment), ainsi que des fibres végétales diverses entrant dans la composition de panneaux moulés.

11. Mais la consommation principale concerne les matériaux naturels, et de préférence, si on peut en disposer, les matériaux alluvionnaires, car ils sont les plus faciles à extraire et à préparer. Cependant, les dépôts de sables, graviers et cailloux naturels sont rarement en condition d'être utilisés tels quels. Ils ont généralement besoin d'être lavés, classés et parfois corrigés, soit en éliminant un excès d'éléments fins, soit au contraire en concassant ou broyant les trop gros éléments, en vue d'obtenir exactement la granulométrie désirée.

12. Il existe pour tout cela des machines relativement simples et d'emploi facile. Le problème n'est pas tellement de se les procurer, que de les choisir rationnellement en vue du travail à effectuer. Chaque gisement présente en effet ses caractères particuliers. Une prospection rationnelle est à effectuer. Des

prélèvements méthodiques permettront de soumettre au constructeur des machines un échantillonnage aussi représentatif que possible des produits à traiter. Une définition précise des produits à obtenir est non moins indispensable. La communication des cahiers des charges, lorsqu'ils existent, peut y aider. Beaucoup de mécomptes et d'échecs résultent de problèmes mal posés. Chaque cas d'application doit être considéré comme cas d'espèce et traité comme tel. Il n'y a pas, dans ce domaine, de machines universelles. Il en sera exactement de même pour ce qui concerne les produits de carrières. Il ne faut pas hésiter à recourir aux services d'un géologue local toutes les fois où l'importance de l'affaire ne justifie pas que, en dépit de l'éloignement, le fabricant responsable des machines se rende lui-même sur place.

13. Les exploitations de carrières ou de gravières peuvent se concevoir, soit à titre permanent soit à titre temporaire.

14. Le premier cas sera celui de gisements placés à côté d'une agglomération en cours d'expansion, ou le long d'un ouvrage (route ou voie ferrée) nécessitant un entretien périodique régulier. On a alors recours à des installations fixes, plus ou moins importantes et plus ou moins compliquées selon les productions à obtenir.

15. Le second cas est celui d'ouvrages nécessitant pendant une période de courte durée (quelques mois ou au maximum quelques années) un afflux important de matériaux. Pour la construction d'un barrage, d'une route, d'une voie ferrée, on pourra ainsi avoir à ouvrir les exploitations temporaires, parfoir avec de très grosses productions journalières, mais dont le débouché disparaîtra avec la terminaison du chantier. On équipe alors ces exploitations avec des matériels mobiles ou semi-mobiles.

16. Il existe, pour tous ces travaux, des gammes très complètes de machines de conception et de tailles très variées, généralement parfaitement au point et bien adaptées aux travaux sur les chantiers, même avec des personnels peu qualifiés et sous des climats rigoureux. La difficulté réside beaucoup plus, nous le répétons encore, dans le choix des types et combinaisons d'appareils appropriés à la nature des produits à traiter et au genre de travail à effectuer, que dans le choix d'une marque.

17. Le travail des machines en carrière, et spécialement celui des appareils de concassage et de broyage, est toujours brutal et pénible. Ces machines nécessitent beaucoup d'entretien. Il ne faut donc pas les mettre en oeuvre sans s'être assuré de l'approvisionnement régulier en pièces d'usure, ni de la disponibilité d'un stock de sécurité des pièces de rechange les plus courantes. A possibilités de service sensiblement égales, il faudra toujours donner la préférence aux machines de la conception mécanique la plus simple, car les démontages et les réparations loin de tout centre industriel posent toujours de graves problèmes. Il faut en tout cas se limiter au choix de machines déjà longuement éprouvées et bien mises au point. Sous prétexte de bénéficier des tout derniers progrès de la technique, certains utilisateurs se laissent convaincre d'expérimenter des prototypes. Ce n'est pas une chose à faire lorsqu'on est installé à plusieurs milliers de kilomètres des usines du

constructeur de ces prototypes. Mieux vaut se contenter de techniques peut-être moins avancées, mais ayant fait leurs preuves.

B - Fabrication d'agglomérés et de produits en béton

18. A partir des agrégats extraits et préparés sur place et d'un liant approprié, on peut fabriquer des éléments de construction normalisés tels que parpaings, panneaux moulés, dalles et bordures, poutres pré-fabriquées, poteaux, bassins, réservoirs, tuyaux, éléments de couverture, etc.

19. Ces fabrications peuvent se réaliser au moyen de machines relativement simples et faciles à conduire. Elles ne nécessitent pas (sauf pour ce qui concerne les produits en amiante-ciment) de très gros investissements. La seule condition est de disposer de matières premières de qualité convenable, ciment de bonne résistance, et agrégats très soigneusement préparés. Un minimum de méthode et de soin dans la fabrication permet alors d'obtenir d'excellents produits. Ces fabrications sont d'autant plus précieuses qu'elles permettent de suppléer, dans une large mesure, à la cherté des produits métallurgiques qui dans les pays neufs sont très fréquemment des produits d'importation.

20. En fait, on peut dire qu'il n'y a pas de différence entre les possibilités d'implantation de la fabrication des produits en béton dans les pays en cours de développement, et dans les pays déjà industrialisés. Les matériels sont les mêmes, l'économie comparable, qu'il s'agisse de petites ou de grandes productions, chaque installation pouvant être exactement conçue en fonction des besoins à satisfaire.

21. Cela pourra aller de la petite fabrication semi-artisanale de parpaings, poteaux, panneaux de clôture, éviers ou abreuvoirs pour le bétail, jusqu'à l'usine à tuyaux frettés destinés à l'équipement d'un aqueduc de plusieurs centaines de kilomètres ou à l'usine de fabrication de traverses de chemin de fer pour une voie ferrée en cours de construction, ou encore de poteaux armés pour une ligne électrique.

22. L'emploi des techniques les plus évoluées telle que la vibration, la centrifugation et la précontrainte, peut être envisagé sous la réserve que le ou les ouvrages à construire représentent un marché suffisant et que l'approvisionnement en matières premières convenables soit assuré. C'est à l'entreprise responsable des travaux d'en juger pour chacun des cas.

C - Fabrication des produits en terre-cuite (briques, tuiles, céramiques

23. Ici, plus encore peut-être que pour les autres matériaux de construction, les possibilités sont commandées par la géologie. Une étude préalable des gisements de terres argileuses est indispensable, tant du point de vue qualité que du point de vue quantité, avant d'entreprendre des investissements.

24. Selon la qualité des argiles disponibles, on pourra envisager la fabrication de produits nobles : tuiles, carreaux, poteries. Ou bien devra-t-on s'en tenir aux produits moyens, obtenus par

filage (presses-filières ordinaires ou à desaération sous vide tels que briques creuses, hourdis, buses, etc. Ou enfin, se limiter à la fabrication de produits pressés en terre franche, c'est-à-dire des briques ordinaires.

25. Dans tous les cas, la préparation de la matière première (argile et matériaux de charge) a une importance primordiale sur la régularité des fabrications. Les fours de cuisson représentent la moitié ou plus du montant de l'investissement, et doivent naturellement être établis avec soin.

26. Actuellement le chauffage au fuel oil est très au point, et étant donné la maniabilité de ce combustible, il y a intérêt à le prévoir, sauf dans les cas, qui restent très exceptionnels, où on trouve un charbon de qualité appropriée sur place.

27. La rentabilité des briqueries et tuileries est très variable. Elle pourra être satisfaisante dans les régions ne disposant absolument pas de pierres ni de ciment. Mais elle sera beaucoup plus difficile à assurer si les produits en terre cuite doivent entrer en compétition avec des produits en ciment moulé fabriqués sur place.

D - Fabrication des liants hydrauliques

28. La chaux et le plâtre sont relativement faciles à fabriquer sous réserve, bien entendu, de disposer des matières premières correspondantes, calcaire ou gypse, qui sont assez communément répandues sur la surface du globe. Il faut noter cependant que tous les calcaires ne se prêtent pas à la fabrication de chaux convenables pour la construction, et que, étant donné la simplicité des moyens mise en oeuvre, aucune correction de la composition des matières premières n'est possible.

29. Sous réserve donc de disposer de matières premières convenables, la fabrication de la chaux et du plâtre est toujours possible sur le plan local, en utilisant tous combustibles disponibles : bois, charbon de bois, houille ou coke, et en mettant en oeuvre des installations relativement simples.

30. Mais les produits obtenus sont utilisables seulement pour la construction légère. La réalisation d'ouvrages de quelque importance nécessite la mise en oeuvre de ciment.

31. La fabrication du ciment Portland artificiel atteint dans les pays industrialisés un haut degré de perfectionnement et nécessite des investissements considérables. Sous l'empire de la concurrence, les prix de revient les plus bas ont été recherchés. Ils s'obtiennent à partir d'unités de production de plus en plus puissantes (1000 tonnes par jour ou plus) de plus en plus automatisés, de plus en plus économiques en combustible et en force motrice.

32. Sauf situation exceptionnelle, de telles unités ne peuvent se justifier dans les pays en début de développement, car leur production n'y trouverait pas de débouchés suffisants, du moins dans un rayon économique accessible.

Par contre, il existe de très bonnes possibilités de production à partir d'unités réduites et simplifiées qu'on pourrait normaliser à 100 t/ jour par exemple. Ces unités seront équipées d'un four rotatif du plus petit modèle, dont la conduite est beaucoup plus facile et qui se prête mieux au traitement de matières premières de qualité variable et incertaine, que les fours à cuve verticaux qui ont été parfois préconisés pour des cas semblables.

34. Pour la même raison de facilité de conduite et de régularité dans la qualité produite, on préfèrera la voie humide à la voie sèche et ceci, malgré la consommation de combustible un peu plus élevée (environ 20 % en plus). Enfin, sauf présence sur place d'un gisement de charbon de qualité appropriée, toutes les fois où le combustible devra être importé, il devra l'être sous forme de fuel oil qui, à puissance calorifique égale, pèse 2,2 fois moins que la houille, est plus facile à manutentionner, et ne nécessite aucune préparation particulière sur place (tandis que les combustibles solides doivent être stockés, analysés, mélangés, séchés et pulvérisés).

35. On peut estimer à environ 12 tonnes de fuel oil ou à 26 tonnes de charbon la consommation journalière d'une usine de 100t/24 heures.

36. La production d'une telle usine qui sera de l'ordre de 25.000t/an, peut s'écouler dans un rayon raisonnable, et il est hautement préférable de répartir plusieurs usines de ce type en divers points de la surface d'un pays très étendu, à faible densité de consommation et disposant de peu de moyens de communication, plutôt que de construire une seule grande usine, aussi moderne soit-elle.

37. Comme dans les pays en début de développement la voie d'eau reste le moyen de transport le plus économique, sinon le seul disponible, il sera préférable d'implanter les usines à ciment au bord de la mer ou sur la rive d'un fleuve.

38. Au fur et à mesure que les besoins croîtront, il sera facile de multiplier le nombre des unités de production, puis de les remplacer par des unités plus puissantes, donc plus économiques.

39. Mais pour l'immédiat, il est inutile de viser à un prix de production comparable à celui des usines des pays très industrialisés, car du fait de l'importance considérable du coût des transports, la production locale restera dans tous les cas compétitive.

40. Une amélioration très nette des conditions de production peut être obtenue si, par chance, on dispose sur place de matières pouzzolaniques, ce qui sera le cas dans la plupart des régions volcaniques. Il suffit en effet de sécher et de broyer ces matières qui, mélangées au ciment, peuvent permettre, toutes choses égales d'ailleurs, de doubler le tonnage produit, sans altérer la qualité. La possibilité de production de ciments pouzzolaniques est donc à considérer avec intérêt.

41. Une autre possibilité à considérer est celle de l'érection, à titre de premier investissement, d'usines de broyage de clinker. Le transport à longue distance du clinker, c'est-à-dire

du ciment brut tel qu'il sort du four de cuisson, est en effet beaucoup moins onéreux que celui du ciment broyé. Il peut s'expédier en vrac, sans aucune précaution spéciale, et ne craint ni les intempéries ni les altérations en cours de route.

42. Lorsqu'on peut s'assurer une source d'approvisionnement régulière en clinker, soit dans le pays même, soit outre-mer, l'édification d'une usine de broyage dans chaque centre de lieux d'emploi pourra constituer une première étape, ou même une étape définitive de l'industrialisation. Ceci sera d'autant plus valable si on peut disposer sur place de matières pouzzolaniques d'addition.

43. On cite même le cas d'ateliers de broyage de clinker implantés dans une région volcanique, et pour lesquels la pouzzolane constitue à la fois la matière d'échange et le frêt en retour avec l'usine d'outre-mer qui leur envoie le clinker.

E - Conclusions

44. La technique, dans les pays qui sont actuellement très industrialisés, a passé par diverses phases. Son histoire marque une évolution lente d'abord, puis de plus en plus rapide, en fonction des conditions ambiantes : état des connaissances, matières premières disponibles, qualification de la main d'oeuvre et des cadres, densité des besoins solvables, importance des disponibilités à investir.

45. Les pays en cours de développement ont un retard plus ou moins grand à rattraper. Est-ce dire qu'ils doivent passer par toutes les étapes qui ont marqué l'évolution des anciens pays ? Certainement pas. Mais ils ne peuvent non plus toutes les franchir d'un seul coup.

46. Dans le cas de la production des matériaux de construction, qui nous occupe ici, il faut en première étape viser à obtenir des produits de bonne qualité, car rien n'est plus désastreux que d'édifier à grands frais des ouvrages susceptibles d'une détérioration rapide, voire d'un écroulement.

47. Dans les pays industriels, la qualité se conjugue au bas prix grâce à la production de masse. Tant que celle-ci ne peut être atteinte, faute d'une densité de consommation suffisante c'est, sans hésitation, le prix de revient qu'il faut sacrifier à la qualité. La seule limite est la comparaison avec le prix des produits importés rendus sur place. Mais, nous croyons l'avoir suffisamment souligné, pour des produits pondéreux tels les matériaux de construction de base (agrégats et liants) il existe une telle marge que, dans la majorité des cas, une fabrication sur place sera rentable, même et surtout si elle est de haute qualité.

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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
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SUMMARY

Agenda Item : D.14

France

THE ADAPTATION OF MACHINERY FOR MAKING BUILDING MATERIALS TO THE NEEDS OF DEVELOPMENT COUNTRIES

By E.C. BLANC, Engineer,
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M.T.P.S.

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THE ADAPTATION OF MACHINERY FOR MAKING BUILDING MATERIALS TO THE NEEDS OF DEVELOPMENT COUNTRIES

By

E.C. BLANC, ENGINEER, CHAIRMAN OF THE MECHANICAL PREPARATION GROUP, SYNDICAT NATIONAL DES MATERIELS d'EQUIPEMENT M.T.P.S.

SUMMARY

In establishing the infrastructure of a country, the building industry is very important, whether it is creating dwellings, public buildings, industrial or commercial buildings, communications, or public works, such as ports, dams, irrigation channels, tunnels, viaducts etc.

These works are all supplied with building materials which are heavy and therefore expensive to transport.

It is essential therefore to use local materials as far as possible.

Whatever is being built, there are two large classes of materials, aggregates and mortars.

Depending on the geology of the surrounding country, aggregates may comprise either:

1. quarried stone (ashlar or rubble masonry, cobblestones, broken stone, fine gravel or sand from crushed stone), or:

2. alluvial material, natural gravel, sand or pebbles, or:

3. clayey material which can harden by drying or baking (brick, tile, pottery etc.)

Mortars to hold the aggregates or stone together are:

1 - either bitumens or hydrocarbons used for making roads and airstrips, or waterproof diaphragms

2 - or hydraulic binders, lime, cement, gypsum plaster, or pozzolanas.

Not every known manufacturing process will be described, nor details given of all the machines which produce building materials.

We will merely emphasise, for each branch of industry, the points which are of interest to development countries, showing how they can find solutions which are both economically feasible and technically advanced.

Two main considerations are common to all building materials:

1. They are minerals. Geology controls them, and nothing should be done before a serious geological survey is made.

2. The quality must be high. Materials are often only a small part of the cost of the work. There should be no risk of premature deterioration or loss of the structure because of misplaced economy in materials.

Two other considerations should govern the choice of plant:

3. The problems should be well stated. Suppliers should be put in possession of all the facts, both on the type of raw materials and on the products to be made.

4. Other production properties being equal, the simplest and strongest equipment is the best.

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Agenda Item: D.3.3

Brazil

THE NECESSITY OF TECHNICAL STANDARDS FOR HEAVY MECHANICAL INDUSTRY AND THE LATIN AMERICAN ASSOCIATION OF FREE TRADE

By Fabiano PEGURIER,
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THE NECESSITY OF TECHNICAL STANDARDS FOR HEAVY MECHANICAL INDUSTRY AND THE LATIN AMERICAN ASSOCIATION OF FREE TRADE

by

FABIANO PEGURIER

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1. The necessity of technical standards for orderly industrial development and technological progress is an acknowledged fact throughout the world; there is no purpose in elaborating on this theme.

2. The modest scope of this work is: (a). To relate briefly the Brazilian experience in the field of heavy mechanical industry, as viewed by GEIMAPE (Executive Group for the Heavy Equipment Industry), and the difficulties encountered, due to the lack of technical standards; and (b). To focus the attention of the participants of this Conference on this problem, which is common to all developing countries in the world, pointing out the need for a coordinated U.N. action in order to solve it.

3. If a frank, open debate on these points follows its presentation, it will have fulfilled its original goal.

4. Before passing on to the main topic, a few words of explanation should first be said about the Brazilian Government's "Executive Group" policy and GEIMAPE.

5. As all nations laboring up the steep initial steps of industrial development, Brazil finds itself nowadays in that classical — and difficult — position of establishing or expanding its basic industries with a minimum of load on its already overburdened balance of payments. In order to coordinate all efforts and decisions, private and governmental, and thus avoid a dispersion of resources, the President of the Republic created a number of Executive Groups, directly responsible to him, for all the industrial sectors in which the most crucial bottlenecks are felt.

6. Working as a council, with representatives of all governmental and private entities that have a bearing on the sector under its jurisdiction, led by a President and an Executive Secretary, each of these Groups is authorized by decree to regulate, guide and supervise all activities in an assigned sector, and to encourage private enterprise to work under its rule by means of special credit facilities and tax exemptions for approved projects. The spectacular success of the first of such Groups (the Executive Group for the Automotive Industry: GEIA, under whose guidance the yearly production of automotive vehicles grew from nil, in 1956, to more than 100,000 units, in 1961) encouraged the Government to create new ones, whose beneficial influence is being deeply felt in the speed of Brazilian industrial development.

7. One of the youngest of these Groups is GEIMAPE.

8. In 1961, the Economic Commission for Latin America (ECLA), with the participation of GEIMAPE and ABDIB (Brazilian Association for the Development of

Basic Industries — a private manufacturers' association represented in GEIMAPE), produced an evaluation of the Brazilian heavy mechanical industry and a projection of its development into the 1961-1970 decade, with two main objectives:

(a). First, an analysis of its capacity to supply the national demand for equipment in five basic industrial sectors: oil and its by-products, steel, electric power, cement and celulose and paper;

(b). Second, a definition of its main problems and a formulation of the measures necessary to make this capacity effective, with maximum utilization of existing production facilities and resources.

9. This study revealed that the national demand for heavy equipment in the five chosen sectors, for the 1961-1970 decade, amounts to an estimated total of US$ 875.3 million. On the other hand, it showed that the local industry could supply approximately 83% of this total, i.e., US$ 725 million, provided, however, that certain obstacles be removed.

10. Among these, the lack of local engineering and of appropriate technical standards assume extraordinary significance.

11. The manufacture of basic industrial equipment, as defined, differs from other industries in that it must be done "to order", according to the characteristics of each case and following an engineering project.

12. Under such conditions, the results of the above-mentioned study, as well as of direct contact with local industry, led to the conclusion that the technological progress of basic industry in Brazil has been retarded by two main factors:

(a). First, the adaptation of foreign know-how to the actual equipment manufacturing resources of Brazil — an adaptation demanded by the engineers who do the designing and buying, usually foreign, with no concern for the country's peculiar conditions, either in the producer or in the consumer market. The construction standards used vary with the origin of the equipment and, therefore, force the local manufacturers to build equipment according to individual solicitations, improvising emergency solutions that are highly detrimental to industrial costs, since the high quality standards demanded constitute an irreducible necessity in the competition with foreign-made equipment;

(b). Second, the fact that the great majority of Brazilian producers of heavy equipment are either affiliated to, or work under license of, foreign firms of such varied origin that it has been impossible to establish what could be termed as technological unity.

13. Therefore, the progress of basic industry in Brazil is at present dominated by the imperative need of technical standards to guide its activities, and of native engineering that would consider the specific industrial conditions of the country.

14. The lack of proper technical standards has been one of the most powerful single factors against this industry because, besides causing unnecessary increases in costs and delays in delivery, with a consequent reduction of the entire producer market, it also inhibits the action of local designers, who could become incentive elements of inestimable importance to this vital industrial sector. As a result, it has now become extremely urgent:

(a). To elaborate proper technical standards, adequate to the nation's present stage of economic and industrial development, to be periodically revised, in order to consolidate the position attained to guarantee the progress of the newly born technology;

(b). To develop these standards in such a manner as to cover harmoniously all production sectors, in order to avoid disrupting discrepancies between interrelated fields.

15. Some attempts have been made to increase the pace of our technocal standardization to a levelccompatible with the speed of our industrial expansion but, despite the efforts of all elements involved, no impressive results have been achieved, due mostly to the lack of organized support of

the industry as a whole, and of financial resources.

16. One initiative that produced outstanding results in the expansion and improvement of basic equipment output is ABDIB, the previously mentioned private manufacturers's association represented in GEIMAPE. Born of the need and the opportunity of supplying PETROBRÁS (the state-controlled oil monopoly) with drilling and refining equipment, it meant the manufacturers' realization that, instead of competing among themselves in a relatively small market like Brazil, they could accomplish more by complementing each other's capacity. As a result, it spurred the production of oil-refining equipment to such a level that more than 70% in value of the newest PETROBRÁS refinery of Duque de Caxias was built in Brazil. It has also achieved equally important results in other fields, besides oil-refining equipment, but not in standardization, because, out of an understandable desire to coordinate all efforts and unify all results, it supports and depends upon ABNT (Brazilian Technical Standards Association). The latter, however, being a private association officially recognized by the Government as sole authorized standardization agency, fights against both negative factors mentioned above.

17. In a new attack on the problem, GEIMAPE, ABDIB and ABNT have jointly devised a Special Program, to elaborate some very badly needed standards. If successful, this Program will give new directives to the solution of the standardization problem. It will extend itself for two and a half years, divided in five one-semester phases, previously and separately planned. Its objective, in these five semesters of activities, will be the elaboration of approximately:

90 raw materials specifications;
8 basic test methods; and
8 construction standards

chosen by ABDIB as the most needed. Recognizing the primary importance of specifications and standards for raw materials and equipment for chemical processing industries, most of the Special Program's work will be dedicated to this sector.

18. The following working method will be obeyed:

(a). To save time, a team of four specialists, with the necessary office help, will apply itself, whenever possible, to the translation and adaptation of foreign standards to Brazilian conditions and units and, only when necessary, will elaborate completely new standards.

(b). The appreciation and approval of each standard will be carried out by a Standardization Commission, drafted by ABNT for this purpose, with the following composition:

1 President — one of the Program's specialists, charged with that particular standard, who will vote only when all other votes come to a draw;

2 Representatives of Equipment Manufacturers — elected by interested firms;

2 Representatives of Raw material Producers — also elected by interested firms;

2 Representatives of Consumers — also elected by interested firms;

1 Representative from involved Government Agencies;

1 Representative from technical associations or laboratories;

1 Representative of ABNT.

As an incentive to their participation in the Commission's work, the members will be remunerated according to their presence at the Commission's meetings. It is estimated that an average of two Commission meetings per standard will be necessary.

(c). For each approved standard, a Permanent Commission will be nominated, which will examine all revisions or modifications that are deemed necessary or solicited by interested elements for that particular standard. Each Permanent Commission will be composed of firms closely related to the manufacture and utilization of the materials and/or equipment covered by the respective standard. The choice of a firm for a Permanent Commission will assume, as in other countries, an honorary character, due to the technical advantages and prestive accorded to elected firms. In this case, their representatives will not be remunerated and more than three absences from Commission meetings will automatically exclude the uninterested firm.

(d). Two foreign specialists, to be solicited from the United Nations Special Fund for Technical Assistance, will collaborate with the local team as consultants. They will supervise the work and contribute with their experience and unbiased opinion to the selection and approval of easily acceptable standards.

19. At a total estimated cost of US$ 200,000, it is believed that this Special Program will fulfill Brazil's most imediate needs and, still more important, that it will establish new directives for the introduction of standardication in the country.

20. Up to this point, we have related here our experiences, our difficulties and our hopes, in the belief that they can serve as orientation to other countries facing similar problems.

21. There still remains, however, the important international aspect of standardization, which has not yet been satisfactorily faced by developing nations, nor by the United Nations Organization.

22. This aspect concerns primarily countries like the members of the ALALC (Latin American Free Trade Association), whose ultimate goal is the pooling of their individual resources for a faster development of the group as a whole.

23. The ALALC is a novel initiative, It differs from its existing counterparts in several basic points. Among them:

(a). It has no "mother" country from which to import its technology, like the British Commonwealth;

(b). Its members are not in an advanced industrial stage, as the original members of the European Common Market;

(c). None of its members have any kind of technological unity; on the contrary, in all of them, heavy industry is an amalgam of the various developed technologies of the world.

24. At the present time, all the more industrialized members of the ALALC are going through a phase of acute demand for heavy equipment. In such a group of countries, of industry and technology of such varied origin, technical standards will necessarily play a vital role in defining the markets for such equipment. If these countries are to complement each other's market, not a single one of the entire group can afford to ignore the other's technical standards —in other words, the stage of their technology.

25. In view of this situation, it is at this point, when standardization is either nonexistent or at an incipient stage, that a concerted group action will prove the most effective and beneficial; specially so if such an action is sponsored by the United Nations, being, as it is, above all the regional arguments that will inevitably arise.

26. It is hard, at the present time, to define what specific course this action should take, but the fact remains that a study of the necessary steps in standardization that a country, or a group of countries, should take, in accordance with its stage of industrialization, is one of the greatest contribution that the United Nations Organization could and should make to its newly developing members

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ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.3.3

Brazil

THE NECESSITY OF TECHNICAL STANDARDS FOR HEAVY MECHANICAL INDUSTRY AND THE LATIN AMERICAN ASSOCIATION OF FREE TRADE

By Fabiano PEGURIER,
Technical Assistant,
Executive Group
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Rio de Janeiro, Brazil

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THE NECESSITY OF TECHNICAL STANDARDS FOR HEAVY MECHANICAL INDUSTRY AND THE LATIN AMERICAN ASSOCIATION OF FREE TRADE

by
FABIANO PEGURIER

Technical Assistant, Executive Group for Heavy Mechanical Industry (GEIMAPE), Rio de Janeiro, Brazil.

In order to coordinate all efforts and decisions essential to the country's industrial development, a number of Executive Groups were created by the Brazilian Government, to regulate, guide, supervise and encourage all activities in the industrial sectors where the most crucial bottlenecks are felt. The success of this policy is best illustrated by the creation of an automotive industry whose output, starting from nihil in 1956, reached more than 100,000 units in 1961. GEIMAPE is one of the youngest of these groups.

A study done by the Economic Commission for Latin America in 1961, with the participation of GEIMAPE and ABDIB (a private manufacturers' association), revealed that the national demand for heavy equipment in five chosen basic sectors, for the 1961-1970 decade, amounts to an estimated total of US$ 875.3 million, of which approximately 83%, i.e., US$ 725 million could be supplied by the country's industries, provided that certain obstacles be removed. Among these, the lack of proper technical standards assumes extraordinary significance.

The conclusion was reached that the technological progress of basic industry in Brazil has been retarded by two main factors: First, the adaptation of foreign technical know-how to the nation's manufacturing resources, with no concern for its peculiar conditions; Second, the fact that there is no technological unity in the country.

Under such circumstances, technical standards have now become an imperative need.

All attempts to increase the pace of technical standardization to a level compatible with the speed of the nation's industrial expansion have failed to a large extent, due to the lack of organized support of industry as a whole and of financial resources. A new attempt is now being made with the creation of a Special Program, which will develop the most badly needed standards under new working methods. It is believed that this plan will establish new directives for the solution of the standardization problem in Brazil.

However, the international aspect of standardization can only be solved by coordinated international action. This aspect concerns primarily countries like the members of the Latin American Association of Free Trade (ALALC), whose ultimate goal is the pooling of their individual resources for a faster development of the group as a whole. In such a group, technical standards will necessarily play a vital role in the definition of the common market and no country can afford to ignore the others' technical standards, i.e., teir stage of industrial development.

It is at this point, when standardization in the group is either nonexistent or at an incipient stage, that a concerted group action will prove the most effective and beneficial — specially so if sponsored by the United Nations Organization.

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CONFÉRENCE DES NATIONS UNIES
SUR L'APPLICATION DE LA SCIENCE ET DE LA TECHNIQUE
DANS L'INTÉRÊT DES RÉGIONS PEU DÉVELOPPÉES

Point de l'ordre du jour : D.13/D.14

France

ETABLISSEMENT D'UNITES DE PRODUCTION DE PRODUITS DE TERRE CUITE EN REGIONS PEU DEVELOPPEES

Par C. JACQUESSON,
Directeur général

et R. HIEBEL,
Centre Technique des Tuiles et Briques

Les mémoires rédigés à l'intention de la Conférence des Nations Unies sur l'application de la science et de la technique dans l'intérêt des régions peu développées sont des documents de travail. Ils sont publiés tels qu'ils ont été présentés et les assertions et opinions qu'ils contiennent sont celles de leurs auteurs.

NOTES

1. Les mémoires choisis pour être présentés en séance générale pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

2. Les mémoires choisis pour être présentés en séance spéciale pourront être obtenus à la Conférence dans l'une seulement de ces langues officielles.

3. Les résumés qui ont été rédigés pour tous les mémoires par les auteurs de ceux-ci pourront être obtenus à la Conférence dans les langues officielles suivantes des Nations Unies: anglais, espagnol, français et russe.

4. Préalablement à la Conférence, les mémoires et les résumés ne feront pas l'objet d'une distribution générale mais d'un tirage restreint destiné aux délégations des gouvernements et autres participants officiels. La publication et la distribution générale des actes de la Conférence s'effectueront conformément aux règles et pratiques agréées par le Comité des publications des Nations Unies.

ETABLISSEMENT D'UNITES DE PRODUCTION DE PRODUITS DE TERRE CUITE EN REGIONS PEU DEVELOPPEES

par C. JACQUESSON, Directeur Général, et R. HIEBEL

- Centre Technique des Tuiles et Briques

1 - INTRODUCTION -

a) L'activité de la construction est un critère de bonne santé économique : construire c'est répondre à un des besoins essentiels de l'homme.

b) Dans les années qui ont suivi la dernière guerre des conceptions nouvelles et des modes de réalisation nouveaux sont apparus dans le bâtiment. Ils ont suscité des engouements et des enthousiasmes mais après n'avoir pu imaginer le bâtiment moderne qu'en béton, métal ou verre, on reconnaît maintenant, à nouveau, les avantages innombrables du matériau traditionnel en terre cuite lorsqu'il est employé correctement.

c) De ce fait l'industrie de la terre cuite connait une activité renouvelée, elle suit efficacement l'évolution de la construction, son avenir est prometteur car ce matériau ancien est toujours un matériau moderne.

d) Pour un pays en voie de développement, il semble naturel et parfaitement logique quand on pense construction, de chercher tout d'abord à utiliser les matières premières du pays même. Or, l'argile est très largement répartie dans le Monde et chaque pays possède des gisements intéressants. C'est pourquoi il nous apparaît qu'une des premières industries susceptibles d'intéresser les pays en voie de développement est celle de la terre cuite.

e) L'objet même de cette conférence est d'étudier l'établissement d'unités de production de terre cuite dans des régions peu développées.

f) Afin que les auditeurs peu familiarisés avec ce type de matériau puissent suivre avec fruit cet exposé nous nous proposons tout d'abord de rappeler le processus général d'une fabrication de terre cuite.

g) Puis nous déterminerons les facteurs essentiels dont il doit être tenu compte pour décider l'installation d'une usine de terre cuite et déterminer son lieu d'implantation.

h) Nous poursuivrons cette étude par l'examen des caractéristiques de principe d'une unité de production adaptée aux régions peu développées : choix du produit, besoins essentiels en énergie, en matériel et enfin en hommes.

j) Pour terminer, nous exposerons, en détail, un cas de réalisation concret où le Centre Technique des Tuiles et Briques de France a fait les études nécessaires à la construction d'une usine à Niamey dans la République du Niger.

2 - PRINCIPE GENERAL DE FABRICATION -

a) Les matériaux de terre cuite sont fabriqués à partir d'argiles auxquelles on ajoute, parfois, des minéraux (sable ou matières combustibles), la matière première essentielle demeurant l'argile, appelée communément terre. L'argile est un silicate d'alumine hydraté plus ou moins pur, d'origine sédimentaire et détritique. Elle se présente sous la forme de roche tendre, friable, imperméable, de coloration variée. Les argiles cuites ont une gamme de tonalité plus restreinte. Les caractéristiques primordiales de l'argile sont son adaptation à devenir plastique par ajout d'une certaine quantité d'eau, à conserver sa forme lorsque cette eau a été évacuée et à acquérir par la cuisson les caractéristiques qui la rendent propre à son utilisation pour la construction.

b) Les variétés d'argile propres à la fabrication de matériaux de terre cuite sont nombreuses. Celà entraîne la nécessité de s'adapter à la terre considérée après l'avoir étudiée en laboratoire et avoir déterminé les types de produits qui correspondent aux possibilités de cette matière première. La fabrication sera faite en pâte sèche, en pâte ferme ou en pâte molle selon les cas. La terre sera pressée ou filée selon les terres et les produits que l'on entend fabriquer. La nature de

l'argile explique souvent la spécialisation des usines dans tel ou tel produit (par exemple : tuiles, briques pleines ou briques creuses).

c) L'exploitation des argiles est liée aux gisements existants d'argile de qualité. C'est pourquoi, généralement, la production se concentre dans les régions offrant les meilleurs gisements.

d) L'exploitation des argiles se fait toujours à ciel ouvert.

e) L'extraction proprement dite peut se faire à l'aide de moyens humains ou mécaniques. Le choix du matériel est fonction de la nature du gisement, des quantités à exploiter, de l'homogénéité et de la nature de l'argile, de la régularité de l'épaisseur, de la dureté de l'argile et de la présence d'impuretés. L'exploitation d'une carrière se fait souvent en deux parties : enlèvement des stériles ou découverte et extraction de l'argile : les moyens utilisés étant les mêmes pour les deux matières; dans certains cas de petites productions l'extraction se fait manuellement.

f) Le transport de l'argile de la carrière à l'usine est une manutention qu'il est souhaitable de réduire le plus possible. Les systèmes employés sont conditionnés par les distances de la carrière à l'usine ainsi que par ses facilités d'accès. Citons les plus courants : convoyeur à bandes pour de courtes distances, wagonnets poussés à bras, wagonnets avec traction animale utilisée encore dans certaines régions, locotracteurs et rame de wagonnets, camions bennes, bennes aériennes dans les cas spéciaux.

g) Il existe pour le stockage des terres, deux principes différents :

- le stockage systématique ou pourrissage qui se justifie dans certains cas et permet d'augmenter la plasticité de la terre et améliorer la qualité du produit cuit : la durée du pourrissage est très variable : de 3 à 30 jours.
- le stockage de sécurité qui est constitué, pendant la belle saison, et permet une exploitation continue malgré les difficultés d'extraction ou d'accessibilités de la carrière pendant certaines périodes (gel, carrière inondée, humidité trop importante de la terre ...)

h) L'alimentation d'un stockage de terre peut se faire par simple déversement ou par système de convoyeur à bandes et rouleaux projeteurs. La reprise de la terre est, soit manuelle, soit mécanisée par chariot du type Chouleur; dans certains cas elle est effectuée par excavateur monté sur pont roulant.

j) Nous en arrivons maintenant à la phase active du processus de fabrication, c'est-à-dire la préparation de la pâte. Cette préparation est une suite de mélanges et d'opérations successives réalisées par différentes machines; la terre est broyée, malaxée, cylindrée, mouillée.

k) Cette pâte ainsi préparée est filée dans une mouleuse qui la sort en boudins au profil définitif. Le boudin est coupé à longueur à la sortie de la mouleuse. Les mouleuses actuelles sont pourvues d'une chambre à vide assurant une désaération de la terre favorable à la fabrication. Une technique nouvelle est apparue ces dernières années, elle consiste à injecter de la vapeur sous pression dans le corps de la mouleuse, c'est ce qu'on appelle la fabrication à chaud.

l) Les produits sortant de la mouleuse sont appelés produits crus ou produits verts.

m) Le séchage des produits de terre cuite, c'est-à-dire l'évacuation de l'eau contenue dans la terre peut s'obtenir de différentes façons :

- par séchage naturel : les produits crus sont disposés sous de petits hangars ouverts de tous côtés appelés hallettes.
- en perchers ou chambres légèrement ventilées bénéficiant de l'air ambiant du four,
- en chambres à grande ventilation, avec apport d'air chaud, qui permettent d'obtenir un séchage en 2 ou 3 jours,
- en séchoir-tunnel où l'avance des produits est continue, où l'on obtient des durées de séchage de l'ordre de 12 à 30 heures,
- et enfin par séchage rapide à très forte ventilation : la durée de séchage pouvant être de 1 h.30 à 3 heures.

n) La cuisson se faisait et se fait dans des fours de types très différents : les fours intermittents utilisés de moins en moins; les fours à feu continu (Hoffmann et à galeries parallèles); les fours tunnels qui sont en fait les matériels les plus modernes.

o) Les combustibles utilisés sont principalement le charbon et le fuel-oil lourd mais l'utilisation du bois ne doit pas être exclue a priori.

p) Les produits de terre cuite existent depuis fort longtemps. Ils se sont diversifiés selon les besoins et nous pouvons les classer comme suit :

- éléments pour murs et cloisons : briques pleines spéciales et ordinaires, briques perforées, briques de parement, blocs perforés, briques creuses de conception et de formats divers.
- éléments pour structures horizontale et inclinée : hourdis divers, bardeaux, plafonnettes.
- éléments pour couverture : tuiles canal, tuiles plates, tuiles à emboîtement.
- éléments pour travaux divers : conduits de fumée, conduits de ventilation, tuyaux de drainage, revêtement des sols et des murs.
- éléments de décoration.

q) Après des généralités, passons maintenant à la 3ème partie de cet exposé, c'est-à-dire considérons les facteurs déterminant la création et l'implantation d'une usine.

3 - FACTEURS DETERMINANTS -

a) Les facteurs qui nous paraissent déterminants sont essentiellement les suivants : la matière prémière, le type de produits à fabriquer, l'étude du marché et l'importance de la production qui doit être assurée, les conditions de transport, les possibilités en main-d'oeuvre, l'énergie électrique et calorifique disponible.

i) matière premières

a. L'importance des gisements des matières premières est déterminante. Le transport de l'argile de la carrière à l'usine est un élément très sensible du prix de revient. Il est donc opportun de choisir un gisement en fonction de sa position géographique. En outre, son importance doit être telle que le gisement puisse faire face à des nombreuses années d'exploitation. Seuls des sondages permettent de définir quantitativement un gisement et des analyses de terre en précisent la valeur qualitative. Quelquefois, la pâte doit être composée non seulement d'argile mais aussi d'autres composants, dits "ajouts". Ceux-ci, bien entendu, doivent également être analysés et les mélanges préalablement étudiés.

ii) type de produits à fabriquer

a. Il est toujours souhaitable de spécialiser une usine dans une famille de produits. La fabrication de certains d'entr'eux est relativement plus aisée et nous pensons que c'est d'abord à la production de ces produits de fabrication facile et d'usage très courant que devraient être consacrées les premières usines.

b. La fabrication de briques pleines peut être conseillée. Ce matériau de fabrication simple, est réalisé avec une argile maigre, très siliceuse souvent appelée "Terre Franche". Cette fabrication se fait pratiquement sans préparation, la terre étant extraite de la carrière non préparée, directement pressée, séchée et cuite. Cette fabrication, en France par exemple, est encore fort répandue et parfois revêt encore un caractère artisanal et saisonnier du fait du séchage naturel sous hallettes, mais nous pensons que pour des créations nouvelles le séchage artificiel et la marche continue sont évidemment souhaitables.

c. Les briques creuses de tous formats et hourdis pour planchers nécessitent une préparation de la terre. Le matériel assurant cette préparation est assez onéreux et engage à fabriquer un tonnage journalier minimum pour amortir les investissements.

d. Nous ne parlerons pas ici de la fabrication de produits tels que la tuile ou les conduits de fumée dont la fabrication est plus délicate, nous désirons ici limiter notre sujet.

iii) étude du marché

a. Une étude de marché est évidemment souhaitable pour déterminer l'importance de l'unité à construire. Il faut tenir compte, en particulier, de la proximité d'un centre urbain important, du nombre de bourgades et de villages avoi-

sinants, des éventuelles concentrations de population et, d'une façon générale, du plan de modernisation industrielle et du plan de construction de la région.

b. Cette étude du marché est étroitement liée aux possibilités et au coût du transport.

iiii) conditions de transport

a. Généralement les produits sont acheminées par route, par fer ou par eau.

b. Le bas prix de revient des matériaux de terre cuite et leur poids relativement élevé ont, pour conséquence, une influence particulièrement importante du prix du transport sur le prix au lieu d'utilisation.

c. Le lieu d'implantation de l'usine doit donc être soigneusement déterminé en fonction des possibilités de transport. Souvent, la proximité d'une grande ville qui est un facteur positif pour le marché, est aussi un facteur positif pour les transports, la région étant bien désservie.

iiiii) main-d'oeuvre

a. Le fonctionnement d'une usine de terre cuite entraîne, d'une part, une main-d'oeuvre d'encadrement très qualifiée mais peu nombreuse et, d'autre part, une main-d'oeuvre de production plus importante, peu spécialisée, mais régulière. Il est donc essentiel que l'usine soit implantée dans une région où l'on pourra trouver les cadres et la main-d'oeuvre indispensables, c'est-à-dire vraisemblablement près d'une agglomération importante.

iiiiii) énergies électrique et calorifique

a. Cette industrie, comme la plupart, utilise de l'énergie électrique et du combustible. Il est donc nécessaire de s'assurer la possibilité de disposer en quantités suffisantes de ces énergies. Il est évident que la proximité d'une ligne électrique et la proximité d'une source de combustible sont déterminantes dans le choix du lieu d'implantation. Rappelons que le combustible peut être : bois, charbon, fuel-oil lourd, gaz naturel.

b) Après avoir exposé les facteurs essentiels déterminant l'installation d'unités de production, essayons maintenant de définir un type d'usine correspondant apparemment aux besoins des régions sous-développées. Ce sera la 4ème partie de cet exposé que nous intitulerons :

4 - CARACTERISTIQUES GENERALES DES USINES -

a) En France, les tonnages journaliers s'étalent de la production artisanale (5 à 10 T./jour) jusqu'à la grosse entreprise produisant 300 T/jour. Il semble que l'unité type de production, pour les régions peu développées, doive se situer dans un juste milieu et l'expérience prouve que la production minimale pour obtenir une certaine rentabilité, pourrait être de l'ordre de 20 T/jour. Ce minimum est souhaitable d'une façon plus générale afin que la production sorte du domaine artisanal pour être réellement du domaine industriel. Les considérations qui suivent concernent une unité supérieure à 20 T/jour pouvant aller jusqu'à 50 T/jour. En effet, audelà d'une cinquantaine de tonnes on se trouve généralement devant des unités qui relèvent d'une mécanisation plus poussée et conduisent à des investissements d'un ordre de grandeur très différent.

b) Le choix des matériels dépend évidemment des disponibilités financières ainsi que du désir de création d'emplois nouveaux limitant les mécanisations. Il paraît donc normal, a priori, de s'orienter vers un matériel de qualité mais ne se situant pas nécessairement à la pointe du progrès.

c) Exposons maintenant le principe général de l'usine :

i) Pour la carrière, nous pensons que souvent l'extraction manuelle qui peut être de l'ordre de 8 T/jour/homme devra être adoptée pour limiter les investissements. Quant au transport de l'argile, il sera étudié en fonction de la distance carrière - usine et sera généralement, soit un transport par wagonnet poussé manuellement, soit un transport par camions.

ii) La préparation type dans le cas de produits creux comportera normalement un doseur linéaire - un piocheur pour briser les mottes - une paire de cylindres dégrossisseurs et une seconde paire de finisseurs - un mouilleur-mélangeur. La mouleuse sera du type classique avec pompe à vide pour désaérateur, fabrication à froid.

iii) Le séchage naturel dépendant des conditions de climatologie sera exclu au profit du séchage artificiel dans des chambres à grande ventilation qui assureront une durée de séchage de l'ordre de 3 jours.

iiii) L'apport d'air chaud nécessaire dans ces chambres proviendra de la récupération du four et d'un foyer complémentaire.

iiiii) Pour la cuisson nous conseillons l'emploi de fours à feu mobile, tels que four Hoffmann, qui n'est pas le plus moderne mais qui est particulièrement bien adapté à des productions de l'ordre de celle que nous envisageons.

d) Les conditions d'exploitation pour une briqueterie telle que nous venons de décrire peuvent se résumer de la façon suivante :

i) En énergie, les besoins présumés sont :

a. Pour l'énergie calorifique, de 250 thermies/Tonne (séchage) - de 350 thermies/Tonne (cuisson).

b. Pour la consommation électrique : de l'ordre de 26 KWH/Tonne cuite.

c. Ces chiffres sont des moyennes susceptibles de variations.

ii) Pour la main-d'oeuvre, il y a lieu de prévoir une main-d'oeuvre indirecte composée d'un Directeur d'usine - d'un chef de fabrication ou contremaître - d'un chef d'équipe entretien - de quelques employés de bureau et ouvriers d'entretien.

a. La main-d'oeuvre directe correspond au personnel de carrière - de transport - de surveillance - de la préparation - du chargement à la mouleuse - des manutentionnaires aux séchoirs - d'enfourneurs, de défourneurs au four et de cuiseurs et du personnel de parc et de chargement.

b. Le nombre d'heures d'ouvriers à la tonne cuite est sensiblement variable suivant le matériel utilisé et, bien entendu, selon le rendement de la main-d'oeuvre. On constate pour ce type d'usines des chiffres allant de 3 h.30 à 6 h./Tonne cuite. Il paraît normal d'escompter, en pays en voie de développement, un temps de l'ordre de 5 h./Tonne cuite : ce chiffre correspondant à l'ensemble de la main-d'oeuvre directe et indirecte.

c. Dans une usine de 50 T/jour conduit à une main-d'oeuvre d'environ 30 personnes, et compte tenu du type d'usine les investissements se monteraient à environ 75.000.000 d'anciens francs français.

e) Rappelons que les différents chiffres qui viennent d'être cités, s'appliquent à une fabrication de briques creuses. En cas de fabrication de briques pleines pressées, il est certain que les dépenses à la tonne seraient moindres, le prix de vente des briques l'étant également.

5 - ETUDE D'UNE BRIQUETERIE AU NIGER -

a) Nous en avons terminé maintenant avec les principes généraux et nous allons considérer un cas concret de projet de briqueterie. Dernièrement, sur la demande du Bureau Centre d'Equipement d'Outre-Mer, le Centre Technique des Tuiles et Briques à Paris s'est chargé de l'étude d'un avant-projet de briqueterie pour la région de Niamey, République du Niger. A titre d'exemple, nous allons développer cette étude et les différents points la caractérisant.

b) Exposons tout d'abord les bases de cette étude :

i) Des essais et analyses ont été pratiqués sur les argiles de la région de Niamey : la terre s'est révélée satisfaisante pour une fabrication de produits creux.

ii) Compte tenu d'une étude de marché, la production de l'unité a été fixée à 400 T/mois de produits creux. Le prix de vente moyen d'une tonne pondérée étant de 5.000 F.CFA, départ usine, soit un chiffre d'affaires mensuel de 2.000.000 F.CFA.

iii) La carrière est située sur les bords du Niger et l'usine implantée à 2 km, ce qui entraine un transport de terre par camions.

iiii) Le coût de la main d'oeuvre a été évaluée comme suit : pour le manoeuvre : 400 FCFA/jour - l'ouvrier spécialisé : 600 F.CFA/jour - le surveillant : 1.000 F.CFA/jour - le cuiseur : 100 F.CFA/heure. L'énergie électrique coûte 22 F.CFA le KWH rendu. Le charbon coûte : 12.000 F.CFA rendu. Les carburants : gas-oil : 30 F.CFA/litre et le fuel-oil : 19,5 F.CFA/Kg, auxquels il faut ajouter le transport : 15 F.CFA la tonne kilométrique.

iiiii) Les amortissements ont été fixés pour le Génie Civil à 20 ans, pour le matériel fixe à 10 ans, et pour les véhicules à 4 ans.

c) Cette usine est du type qui a été précédemment défini.

i) L'éloignement de la carrière de 2 Km a impliqué un transport de terre par camions. Pour éviter l'achat d'un matériel d'extraction sous-employé, celle-ci est prévue à la pelle. Des fosses à terre permettant l'humidification sont aménagées. La préparation de l'argile est composée d'un doseur linéaire - d'une paire de cylindres - d'un mouilleur-mélangeur et d'une mouleuse à vide.

ii) Le séchage est effectué dans 4 chambres à grande ventilation alimentées en air chaud par la récupération du four, il n'est pas prévu de foyer d'appoint se réservant la possibilité d'en installer un ultérieurement. La durée de séchage prévue est de 4 jours, l'étude des conditions atmosphériques nous permet d'envisager la chose comme possible la plupart du temps. Le séchage risque d'être ralenti par la trop forte humidité de l'air pendant les périodes froides des saisons des pluies. Pendant les périodes autres, qui sont soit très chaudes, soit très sèches, le type de séchoir proposé permet de conserver l'humidité voulue à la ventilation du séchoir par le réglage simple d'une trappe d'admission et d'une trappe d'évacuation.

iii) Les produits sont disposés sur des planchettes bois s'empilant les unes sur les autres. Chaque chambre contient 15 T. de produits. La ventilation est assurée, dans chaque chambre, par un ventilateur hélicoïde débitant 6 m3/s (puissance unitaire du moteur : 2CV). Signalons que l'installation de 2 chambres supplémentaires permettrait alors de produire 600 T/mois au total.

iiii) Compte tenu du tonnage envisagé et des conditions locales, le four qui semble le mieux adapté est le four Hoffmann. Celui-ci serait d'une section de 3,75 m2 (largeur : 2,20 m - hauteur sous voute : 2,20 m). Ce four contient environ 1.800 Kg de produits par mètre linéaire de four. Pour une production de 400 T/mois ce four serait formé de 2 galeries d'environ 20 m et contiendrait 79 T. de produits. Il serait donc possible de cuire en continu avec une avance de 7,50 m/jour. Si le tonnage cuit tombe en-dessous de 400 T/mois, il faudrait fonctionner en semi-continu ; c'est-à-dire rallumer le feu à chaque tour de four. Dans un tel four, la production maximale est de l'ordre de 6 à 700 T/mois : à noter que ce type de four peut toujours être rallongé.

d) Evaluons maintenant les investissements (ceux-ci sont tous exprimés en Francs CFA).

i) Carrière	: aménagement et wagonnets	400.000
	: camion de 5 T.....	4.000.000
	- soit pour le poste carrière un total de	4.400.000
ii) Préparation - Fabrication		
	: matériels	8.100.000
	: fosse	600.000
	: montage et installation.....	500.000
	- soit, pour ce poste un total de	9.200.000

iii) Séchage : 4 chambres à grande ventilation

maçonnerie et portes	1.300.000	
planchettes supports de séchage	7.450.000	
chariot de manutention	180.000	
ventilateur	350.000	
installation électrique	120.000	
- soit pour le poste un total de		9.400.000

iiii) Cuisson : Four Hoffmann
maçonnerie et fondations, matériel et accessoires 10.000.000

iiiii) Installation électrique

: Poste de transformation pour 90 CV.	1.500.000	
: Raccordement haute tension.....	1.500.000	
: Réseau basse tension intérieur..	1.000.000	
- soit , au total		4.000.000

iiiiii) Distribution d'eau

: Pompage au Niger, amenée à l'usine distribution aux fosses et au mouilleur-mélangeur	3.000.000	
: Bâtiment et sol; nivellement du terrain de 3.000 m2.....	200.000	
: 1 bâtiment de 14 m x 42 m	2.300.000	
: 2 bâtiments de 23 m x 8 m	1.350.000	
: Appentis de 20 m x 8 m.....	300.000	
: Bétonnage du sol	2.300.000	
- soit au total		7.000.000

iiiiiii) Travaux divers

: aménagements des accès - entourage - bureaux - imprévus 3.000.000

iiiiiiii) Le total des investissements se situe à 50.000.000 F.CFA

c) Organisation - Personnel - Dépenses d'exploitation (toutes les dépenses figurent en F.CFA).

1)- Main d'oeuvre

a. A la carrière, 2 hommes assurent l'extraction de 17 T.terre/jour, la mettent dans des wagonnets et la basculent dans le camion qui vient se mettre en contrebas. Les dépenses mensuelles entraînées par ces 2 hommes sont de : 400 F/jour x 2, et pendant 25 jours, soit 20.000

: 1 chauffeur travaillant d'une façon sporadique et revenant mensuellement à 1.250

: Le camion(20 F/Tonne kilométrique)revient mensuellement à 16.000

b. Préparation :

: 3 hommes assurent le service suivant : reprendre la terre déversée par le camion et la répandre dans la fosse,arroser la terre par couches de 10cm : reprendre la terre humide et la charger dans les wagonnets,rouler ceux-ci et les vider dans le doseur en début de chaine de préparation.Ces 3 hommes reviennent pour les 25 jours mensuels à 30.000

c. Fabrication :

: 1 surveillant, à mi-temps, assure le mouillage pendant 25 j (surveillera l'enfournement pendant le reste de la journée), il revient mensuellement à. 25.000

: 1 coupeur, 2 preneurs à la mouleuse et 1 rouleur au remplissage des séchoirs: ces 4 hommes travaillant à mi-temps 20.000

d. Séchage : le règlage des séchoirs se fait une fois par jour et doit être commandé par le Directeur de l'usine. Le vidage des séchoirs (1 chbre/jour) se fera en liaison avec l'enfournement.

e. Cuisson : la cuisson proprement dite demande :(mensuellement)

- 4 cuiseurs à 100 F/h, 8 h/j pour assurer la continuité de la cuisson..... 73.000

le défournement de 15 à 16 T/j est effectué par:

- 3 hommes qui assurent également le chargement des camions en produits cuits..... 45.000

le vidage des séchoirs et l'enfournement sont effectués par les 4 hommes assurant la fabrication à 1/2 journée, Dépense mensuelle..... 30.000

Volant de main d'oeuvre :

- 2 hommes qualifiés manoeuvres, soit mensuellement. 20.000

f. Le personnel direct s'élève donc à : 20 personnes, entrainant des dépenses mensuelles totales de 264.500 F. CFA.

ii) Dépenses d'énergie électrique

a. Préparation - Fabrication :

67 CV utilisés pendant 4 h/j, soit pour 85j./mois...1.100.000

b. Au séchage : 8 CV fonctionnent pratiquement en permanence, soit mensuellement 95.000

c. Cuisson : 9 CV en permanence, dépense mensuelle..... 105.000

d. Eclairage et divers : mensuellement 20.000

iii) Dépenses de combustible

a. Les dépenses de combustible pour la cuisson se chiffrent à 780F/T. (cuisson au charbon - 65Kg à la T.cuite, compte tenu de la mauvaise qualité des charbons du Nigeria) et 960 F/T.(cuisson au fuel). Considérons la dépense maximale 385.000

iiii) Entretien

a. L'entretien peut être fait par des entreprises extérieures bénéficiant de l'aide du personnel de l'usine : évaluons le coût forfaitairement à 1 % du chiffre d'affaires, soit mensuellement... 20.000

iiiii) Un service Ventes - Un bureau s'occupant de la sortie des produits, des commandes diverses, des bordereaux de salaires et de la tenue des livres de la comptabilité, entrainent les traitements d'un employé et les honoraires d'un expert-comptable, soit mensuellement..... 35.000

iiiiii) Les amortissements entrent dans le compte d'exploitation de la façon suivante :

a. Le matériel roulant, c'est-à-dire le camion, n'est pas compté, son amortissement étant inclus dans le prix de revient de la tonne kilométrique.

b. Le matériel amortissable en 10 ans, représente: 256.000

c. Le matériel amortissable en 20 ans, représente: 100.000

d. ..... soit un total mensuel de 356.000

iiiiiii) Récapitulons maintenant les dépenses d'exploitation et les prix de revient techniques (comptes mensuels).

a. Frais proportionnels

: Main d'oeuvre directe	264.000	13,2 %
: Energie électrique	330.000	16,5 %
: Combustible de cuisson	385.000	19,0 %
: Transport de la terre	16.000	0,8 %
: Entretien	20.000	1,0 %

b. Frais fixes

: Direction et frais divers	300.000	15,0 %
: Bureaux	35.000	1,75 %
: Amortissements	350.000	17,5 %
soit un TOTAL DE :	1.700.000 F.CFA	

c. Ceci représente environ 85 % du chiffre d'affaires qui est, nous le rappelons, de 2.000.000 F.CFA.

f) Examinons la rentabilité de cette usine :

i) Le bénéfice mensuel apparaissant est de 300.000 F.CFA, soit 15 % du chiffre d'affaires. Sur une production de 400 T., ce chiffre est moyen et valable. Notons, toutefois, que de ce bénéfice il convient de retrancher l'intérêt des capitaux empruntés, et, éventuellement, les frais d'achats de terrains pour les besoins de l'usine et de la carrière

ii) En examinant ces chiffres et les courbes de rentabilité nous constatons que le seuil de la rentabilité de cette usine se situe autour de 290 T/mois. Dans l'avenir pour avoir une marge bénéficiaire plus correcte, il faudrait augmenter le chiffre d'affaires: ceci doit pouvoir se faire en augmentant la production(les matériels prévus permettent cette extension mais ceci dépend évidemment de la capacité d'absorption du marché) et on pourrait également envisager la fabrication des produits spéciaux tels que : tuiles canal, dalles de pavage intérieur, et ultérieurement, planchers ou plafonds préfabriqués;cette nouvelle fabrication n'intervenant évidemment qu'après un certain rodage du personnel et des matériels.

6.- CONCLUSION.

a) Nous n'avons volontairement pas envisagé la construction d'une unité de production plus importante : disons cependant que près d'un très grand centre urbain, une usine de plus de 100 à 150 T/j ne serait pas à écarter si le marché le permet. Signalons au passage qu'une telle usine suppose une surface couverte de 5.000 m2 environ,des investissements de l'ordre de 300 à 350 Millions; le prix de revient est bien entendu meilleur,les matériels plus mécanisés;la consommation en énergie électrique,de l'ordre de 40 KWH à la T.cuite,le séchage demandant 250 thermies/T. et la cuisson environ 320 thermies/T. La main d'oeuvre incorporée peut être, dans ce cas de l'ordre de 2 h 5/10° à la Tonne.

b) Si nous nous sommes volontairement limités dans cet exposé à envisager des usines de 20 à 50 T/j, c'est parce que leur équipement nécessite des moyens relativement plus réduits et qu'en outre il est toujours possible de prévoir l'extension d'une usine de terre cuite. Nous n'espérons certainement pas avoir épuisé l'objet de cette conférence, mais nous souhaitons avoir dégagé quelques principes et cité quelques chiffres permettant de situer le problème.

c) Dans tous les cas, une étude préalable,un avant-projet puis un projet considérant de très près les conditions particulières à chaque usine, seront nécessaires.

d) Signalons que le Centre Technique des Tuiles et Briques, en France, souhaite pouvoir apporter une collaboration efficace aux Pays qui désireraient bénéficier de l'expérience acquise en ce domaine.

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SUMMARY

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France

ESTABLISHMENT OF PRODUCTION UNITS FOR CERAMIC PRODUCTS IN UNDER-DEVELOPED REGIONS

By C. JACQUESSON,
Director-General,

and R. HIEBEL,
of the Technical Centre
for Tiles and Bricks

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ESTABLISHMENT OF PRODUCTION UNITS FOR CERAMIC PRODUCTS IN UNDER-DEVELOPED REGIONS

By
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OF THE TECHNICAL CENTRE FOR TILES AND BRICKS

1. AIM

The object of this communication is in the first place to determine the essential factors which must be taken into account in deciding on principles when setting up a ceramics factory and in the choice of a location.

We then propose to describe the general procedure of manufacture of ceramic goods, in order to familiarise listeners with the different steps in factory production.

We next seek to determine the smallest production which appears desirable, and the problems which arise, that is essential requirements of energy, labour and material.

2. FACTORS GOVERNING THE ESTABLISHMENT OF A CERAMICS FACTORY

It is essential to make an initial study of the market for ceramic goods. This market depends on the proposed construction programme and the setting-up of the factory must pay the greatest attention to the proximity of a substantial urban centre, which is almost essential: the transport factor as regards bulky and heavy products is of prime importance.

The next stage is to ensure that there is a sufficient deposit, as indicated by detailed tests, so that there is a source of raw material which will last for many years' production.

It will be necessary to analyse this clay so as to know its properties and to determine the mixtures of earths to be adopted in order to obtain good quality products.

The operation of a ceramics factory calls for a small number of highly skilled key workers, as well as a larger number of less specialised workers, who must attend regularly. It is therefore essential for the works to be situated in a region where this labour can be found, both skilled and unskilled; that probably means near a large town.

We must repeat that transport conditions are also a

determining factor. The products may be moved by road, rail, or water.

This industry makes use of electrical energy and of fuel. The fuel may be either wood, coal, or natural fuel or gas. It is evident that the proximity of an electricity supply and of a source of fuel are prime factors in the choice of the factory site.

3. GENERAL PROCESS OF MANUFACTURE

It now appears opportune to describe the general process of manufacture of ceramic articles, so as to give some idea of the successive steps involved.

The clay is first placed into store. In some cases it must be systematically stacked: this helps the ageing process to make it suitable for manufacturing purposes.

When the clay is brought into the works, it must then be prepared. This preparation often consists of mixing several clays and then adding a degreasing agent such as sand; the mixture is then ground, beaten, rolled and moistened in order to give a plastic paste suitable for shaping.

The shaping consists of pressing the paste through a mould which causes it to extrude with a definite profile. The material is then cut into separate units.

The product is then dried; the water may be removed naturally, or in chambers heated by the ovens, or in well-ventilated chambers into which hot air is passed, or in drying tunnels where the products pass through continuously.

Once the product is dry, it is ready for baking. This operation can be carried out in intermittent ovens, which are used less and less, or in ovens with moveable source of heat (Hoffmann ovens, ovens with parallel galleries); this procedure is now used most frequently.

4. CONSIDERATIONS ON A PRODUCTION UNIT OF 20 TO 50 TONS PER DAY

Experience shows that the least production to be a paying proposition is of the order of 20 tons per day. The following considerations are relevant to a unit producing more than 20 tons per day, e.g. one producing 50 tons per day, which would clearly be more profitable. Beyond about 50 tons we reach production problems calling for elaborate equipment and requiring an investment of a very different order of magnitude.

It is important to study the market from the outset so as to decide upon the product or products to be manufactured in the works. It seems logical to turn to those products in commonest use. For this reason we will limit our discussion to solid pressed bricks and to hollow ware.

It is to be noted that a factory producing solid pressed bricks calls for a smaller investment; indeed there is practically no need for preparation, as the clay passes straight from quarry to press.

As for choice of material, it is logical to have regard to basic factors such as the financial factor which often limits the investment available, and the desire to create new employment, which sets a limit to mechanisation.

It therefore appears reasonable to start thinking in terms of a quality product, but not necessarily one at the spear-head of progress.

We are of opinion that manual extraction from the quarry will often be adopted so as to limit the financial commitments.

Transport of the clay will be considered in terms of distance.

Preparation must be studied in terms of the clays available.

The mould will be of traditional design, with vacuum pump, for production in the cold.

It would be advantageous to provide for drying in chambers with good ventilation (duration: about 3 days) with a supply of hot air from the oven and from a supplementary hearth. We consider that natural drying, which is clearly the least costly, is not to be used, especially in countries where the relative humidity is often very high.

For the baking process, we advise the use of ovens with portable heating arrangement, such as the Hoffmann oven, which is not the most modern but which is particularly well adapted to productions of the magnitude we are discussing.

The thermal energy required can be calculated on a basis of 250 thermies per ton dried artificially, and for firing, 350 thermies per ton fired. These figures are averages subject to appreciable variations.

The electricity consumption is in the region of 26 kwh per ton fired.

The labour requirements comprise indirect workers and direct workers.

The total number of man-hours required per ton fired varies greatly according to the material used and the degree of mechanisation of the works, and of course according to the skill of the workers. Figures have been obtained ranging from less than 3, up to 6 hours per ton fired. It appears normal to allow a time of about 5 hours per ton, in countries in course of development; this figure is the total of direct and indirect labour. A works producing 50 tons per day would therefore require a labour force of about 30 persons.

5. PILOT BRICKWORKS AT NIAMEY (Niger Republic)

The TECHNICAL CENTRE FOR TILES AND BRICKS has been recently requested by the CENTRAL BUREAU FOR OVERSEA EQUIPMENT (B.C.E.O.M.) to set up a brickworks as a pilot scheme for the NIAMEY region.

Owing to space limitations, we cannot give complete data here, but only a summary.

6. CONCLUSIONS

We are of opinion that ceramics factories are among the first industrial plans to be considered by an underdeveloped country. These factories satisfy an essential need, that of construction, and they use a raw material existing on the spot. Finally, apart from key workers, the labour force required is unspecialised.

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